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THE JOURNAL OF DENTAL RESEARCH

(Continuing the Journal of the Allied Dental Societies)

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Important Books Received

Textbook of physiology. By William D. Zoethout, Ph.D., Professor of Physiology, Chicago College of Dental Surgery, Loyola University. *Second edition.* 1925: pp. 616; 6¼ x 4 in.; 186 illustrations, $4.50. C. V. Mosby Co., St. Louis.

Physiological chemistry; textbook and manual for students. By Albert P. Mathews, Ph.D., Professor of Biochemistry, University of Cincinnati. *Fourth Edition.* 1925: pp. 1233; 7¼ x 4½ in.; 109 illustrations; $6.50. William Wood and Co., New York City.

Bacterial infection, with special reference to dental practice. By J. L. T. Appleton, Jr., B.S., D.D.S., Professor of Microbiology and Bacteriopathology, Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania. 1925: pp. 474; 7¼ x 4 in.; 96 illustrations; $6.00. Lea and Febiger, Philadelphia.

Physical chemistry in biology and medicine. By J. F. McClendon, Ph.D., Professor of Physiologic Chemistry, and Grace Medes, Ph.D., Assistant Professor of Physiologic Chemistry, Medical School, University of Minnesota (Minneapolis). 1925: pp. 425; 6¾ x 4 in.; 34 illustrations; $4.50. W. B. Saunders Co., Philadelphia and London.

Dental materia medica and therapeutics, with special reference to the rational application of remedial measures to dental diseases. By Hermann Prinz, A.M., D.D.S., M.D., Sc.D., Professor of Materia Medica and Therapeutics, Thomas W. Evans Museum and Dental Institute School of Dentistry, University of Pennsylvania. *Sixth edition.* 1926: pp. 632; 7 x 4½ in.; 146 illustrations; $6.00. C. V. Mosby Co., St. Louis.

Technic of oral radiography. By Clarence O. Simpson, M.D., D.D.S., F.A.C.D. 1926: pp. 207; 6¾ x 4 inches; 165 illustrations; $5.00. C. V. Mosby Co., St. Louis.

Orthodontics: an historical review of its origin and evolution. *Two volumes.* By Bernhard Wolf Weinberger, D.D.S., Librarian of First District Dental Society of the State of New York, and Advisory Librarian, Dental Department, New York Academy of Medicine, New York City. 1926: pp. 1011; 7¾ x 4¾ in.; 599 illustrations; $25.00 (*two volumes*). C. V. Mosby Co., St. Louis.

American text-book of operative dentistry. By Marcus L. Ward, D.D.S., D.D.Sc., F.A.C.D., Editor; Professor of Dental Metallurgy and Crown and Bridge Work, and Dean, College of Dental Surgery, University of Michigan. *Sixth edition.* 1926: pp. 818; 7¾ x 4¾ in.; 783 illustrations; $10.00. Lea and Febiger, Philadelphia and New York.

Annuario dental 1926. By Salvador de Casas (and numerous collaborators). *Fifth edition.* 1926: pp. 462; 6¾ x 4¾ in.; nearly 200 illustrations; 12 Pesetas. Salvador de Casas, Calle de Galileo, No. 5, Madrid, Spain.

A textbook of exodontia—exodontia, oral surgery, and anesthesia. Leo Winter, D.D.S., Professor of Oral Surgery, College of Dentistry, New York University. 1927: pp. 364; 7¼ x 4½ in.; 329 illustrations; $7.50. C. V. Mosby Co., St. Louis.

Harelip and cleft palate (cheiloschisis, uranoschisis, and staphyloschisis). By Matthew N. Federspiel, B.Sc., D.D.S., M.D., F.A.C.S., Professor of Oral Surgery, Marquette University. 1927: pp. 200; 6¾ x 4 in.; 156 illustrations; $5.00. C. V. Mosby Co., St. Louis.

A text-book of bacteriology for dental students. By Arthur Bulleid, L.R.C.P. (London), M.R.C.S., L.D.S. (England), Assistant Dental Surgeon and Assistant Bacteriologist, Guy's Hospital, London. 1927: pp. 219; 6½ x 4 in.; 60 illustrations; $4.50. C. V. Mosby Co., St. Louis.

Textbook of biological chemistry. By James B. Sumner, Ph.D., Assistant Professor of Biological Chemistry, Cornell University (Ithaca). 1927: pp. 283; 6¾ x 4 in.; 6 illustrations; $3.50. MacMillan Co., New York City.

The contributions of the Eastern Association of Graduates of the Angle School of Orthodontia to Orthodontics. A review and index of its proceedings. By Bernhard Wolf Weinberger, D.D.S. 1927: pp. 48; 7½ x 4¾ in.; no illustrations. Eastern Association of Graduates of the Angle School of Orthodontia.

Gangrene of the dental pulp and its treatment, as based on a biochemical investigation. By Gustav Hedstrom (translated by Carl Westman). 1927: pp. 178; 6¾ x 4 in.; 35 figures. Dental-aktiebolaget, Stockholm, Sweden.

Lectures [6] on the biologic aspects of colloid and physiologic chemistry. A series of lectures given at the Mayo Foundation and the Universities of Minnesota, Iowa, Washington (St. Louis), and the Des Moines Academy of Medicine, Iowa. By six investigators in the field. Introduction by Louis B. Wilson, M.D., Director of the Mayo Foundation for Medical Education and Research. 1927: pp. 244; 6¼ x 3¾ in.; 85 illustrations; $2.50. W. B. Saunders Company, Philadelphia and London.

American illustrated medical dictionary. By W. A. Newman Dorland, A.M., M.D., F.A.C.S., member of the Committee on Nomenclature and Classification of Diseases, American Medical Association, and Editor of the "American Pocket Medical Dictionary;" with the collaboration of E. C. L. Miller, M.D., Professor of Bacteriology and Biochemistry, Medical College of Virginia. *Fourteenth edition.* 1927: pp. 1388; 8¼ x 4¾ in.; 319 illustrations; flexible binding—plain, $7.00; thumb index, $7.50. W. B. Saunders Company, Philadelphia and London.

Dental education in the United States and Canada. By William J. Gies, M.S., Ph.D., Sc.D., LL.D., F.A.C.D., Professor of Biological Chemistry, Columbia University; Executive officer of the Board of Editors, *Journal of Dental Research;* with a preface by Henry S. Pritchett, Ph.D., Sc.D., LL.D., Litt.D., President of the Carnegie Foundation for the Advancement of Teaching. 1926 (issued in 1927): pp. xxii + 692; 7¼ x 5 in.; one illustration; distributed free of charge on application, by letter or in person (the volume is "Bulletin No. Nineteen"). Carnegie Foundation for the Advancement of Teaching, 522 Fifth Avenue, New York City.

Physical chemistry and biophysics, for students of biology and medicine. By Matthew Steel, Ph.D., Professor of Biological Chemistry, Long Island College Hospital. 1928: pp. 372; 7¼ x 4½ in.; 38 illustrations; $4.00. John Wiley and Sons, Inc., New York City.

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The six successive numbers in this Volume were issued promptly on the new bi-monthly schedule of publication. See this *Journal*, VI, page iii, and VII, page iii.

ENDOWMENT FUND OF THE JOURNAL OF DENTAL RESEARCH

The urgency of the effort to issue the numbers of the *Journal* promptly on the schedule of publication referred to in the foregoing announcement, and many embarrassments associated with the removal of the editorial office to the new health center, at Broadway and 168th Street have, prevented further effort to increase the Endowment Fund. There have been no important additions since the publication of the report in Volume IV. During 1929, with further reorganization of the editorial office of the Journal, special attention will be given to enlargement of the Fund and to reports regarding it in the next volume.

PROCEEDINGS OF AFFILIATED DENTAL SOCIETIES PUBLISHED AS INDEPENDENT JOURNALS WITHIN THE JOURNAL OF DENTAL RESEARCH

The dental societies named on the title page publish their proceedings on conditions that make each society's group of papers, in effect, its own independent journal within the *Journal of Dental Research*. Papers contributed by societies are controlled and edited by the respective associations through their official representatives. Reprints of sections may be obtained for issuance in separate volumes of transactions. The broad import of this development for the cause of non-commercial journalism in dentistry will become apparent as it evolves in successive issues. See the title page of this Volume, and compare it with that of Volumes V, VI, and VII.

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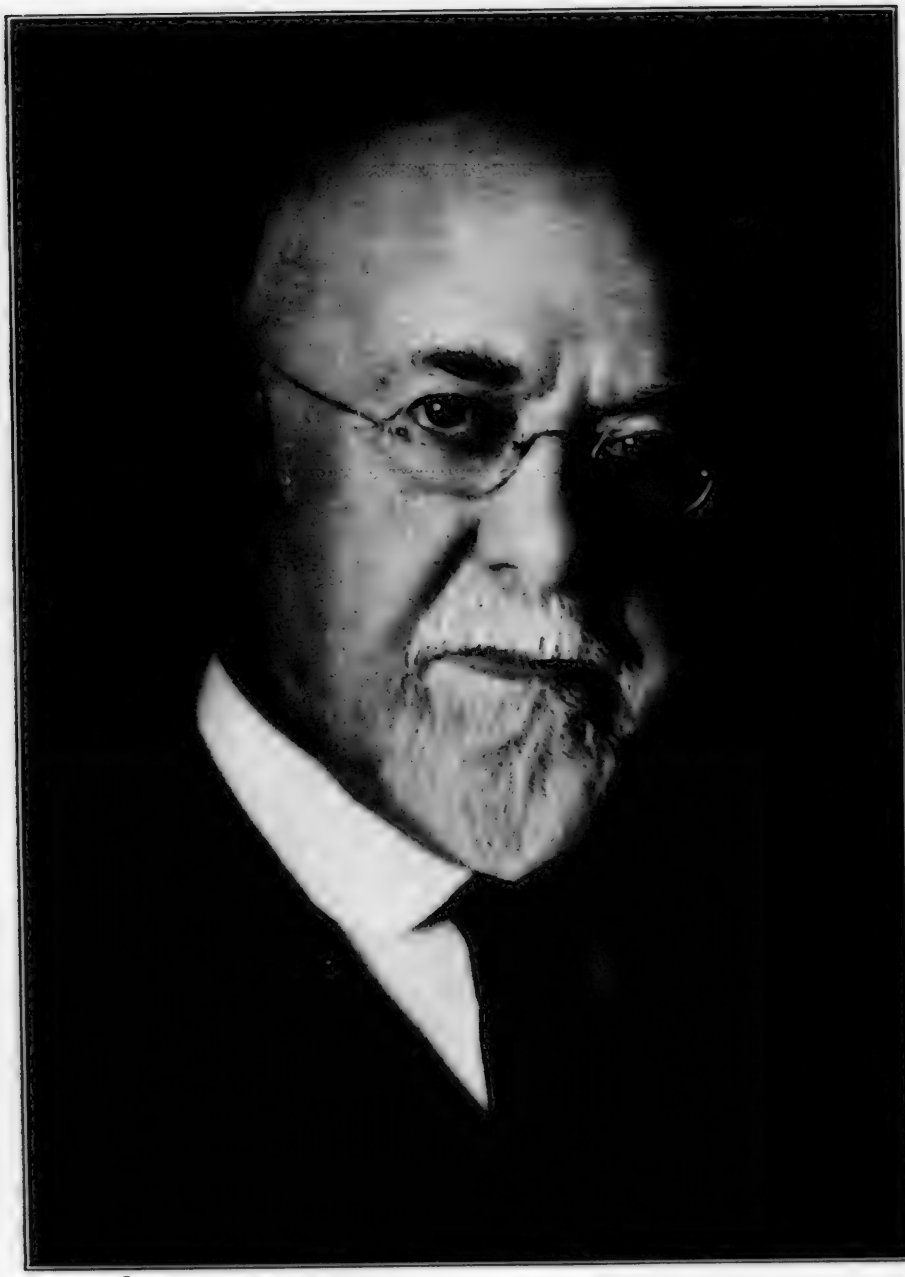

George Andrew Bates

A TRIBUTE TO GEORGE ANDREW BATES[1]

HENRY H. PIPER
Tufts College Dental School, Boston, Mass.

George Andrew Bates, D.D.S., D.M.D., M.S., son of Andrew Bates a native of Ava, New York, and Seyeth Ropes Ames Bates, a native of Orford, New Hampshire, was born in Boston, Massachusetts, August 5, 1847. Soon after his birth his family removed to Weymouth, Mass. When he was five years old, on account of the ill health of his father, another change was made to Ava, New York, the home of his paternal grandparents, where two years later his father died. Shortly after his father's death, he returned with his mother to Boston, and there, and with an aunt in Lowell, Mass., he lived for the next five years, attending the public schools in the two cities. When he was twelve and thirteen he lived in Salem, Mass., attending school there, but leaving before he had completed the grammar school course to assist in the support of the family. After occupying a number of different positions, he entered, in 1875, the Naturalists Supply and Publishing Business in Salem, and later became manager of the Salem Press Publishing and Printing Company, a position he held till 1889, the year of his graduation from the Boston Dental College, where his course of study had been interrupted by a year of absence on account of the demands of business.

His dental course over, Dr. Bates remained in practice three years in Salem, Mass., after which he removed to Auburndale, Mass., and continued in practice there a somewhat longer period, keeping his home in Auburndale to the end of his life. Two years after graduation from the Boston Dental College, he was called to the Chair of Histology in that institution, a position he held till the merging of the College in the Tufts College Dental School in 1900. This re-organization did not affect his relations as a teacher except to give him ampler

[1] Dr. Bates was one of the founders of the International Association for Dental Research in 1920. See the *Journal of Dental Research*, 1926, vi, p. 111.

opportunity in the new institution, an opportunity still farther enhanced by a call to teach in the Tufts College Medical School. In order to enjoy regulation standing in the faculty of the Medical School, it was necessary that he should hold an academic degree, and to this end he prosecuted study and research for several years at Tufts College under Prof. Kingsley of the Biological Department, and at the Laboratory at South Harpswell, Maine, receiving, after presentation of the customary thesis, the degree of M.S. in 1904. In recognition of postgraduate dental and medical work in 1904–05, his degree of D.D.S. from the Boston Dental College was supplemented in 1905 by the degree of D.M.D. from Tufts College.

Dr. Bates was over forty years of age when he left the Boston Dental College; he was well past fifty when he became teacher of histology in the Dental and Medical Departments of Tufts College, and was nearer sixty when he received the degree of M.S. Judging from the evidence, he knew not the slightest wavering in the course to be pursued; rather, one can imagine that he felt the decks now well cleared for action. And what an enthusiastic, joyous, victorious fight it was all the remaining years of his life. What a fruition for one whose grammar school course had been cut short to begin the struggle for bread. What a happy fulfillment of a dream long held that one day he might find congenial work in one of the professions, preferably that of the physician, a dream which led him to matriculate in dentistry as a possible beginning, something nearer his hope than the occupation in which he was engaged, this being all the venture financially he could at the time afford. And it may here fittingly be stated that when once Dr. Bates had entered upon the career of a teacher, he found the practice of dentistry less and less congenial; teaching was the vocation to which he could give the powers of his soul ardently and completely.

All those who knew Dr. Bates well—and certainly all those who were associated with him did know him well, for he was singularly out-spoken—will without hesitation agree that he was an unusually interesting, delightful, and inspiring personality. His mental eagerness and unresting zest for research and reading naturally gave him freshness of spirit, and prevented any crystallizing into routine and stereotyped prosecution of work. His clarity of spirit helped to this

end, his straight-forwardness also, and his satisfaction in what was clean and above-board. No dust was allowed to settle on his mental furniture. One enjoyed being in his presence, in some sort, as one enjoys a work of art that strikingly reveals the soul of the artist, for with him life and living were really an art, the highest art of all, and with unconscious charm he was ever expressing this conviction. Yet one must not forget that his feeling on many questions of moral or ethical procedure, or what he judged to be such, was pronounced, and he pushed his preference in these matters to a point he sometimes regretted. His ideals, also, were high and distinctly his own, and in test cases he was pretty sure to stand by them; though it pained him to cut athwart the feelings of others. But as one looks back upon his judgment in such cases, and one might cite numbers of them, softened by the thought of death, made tender by the sense of human frailty, how they do but enrich a personality of unusual depth and variety and one which will not be likely to grow dim in memory with the lapse of time; a personality strangely cumulative to the very end, with not one day of weakness; strong, fine, rugged, ingenuous to the last. And how memory brings back a ring in his voice, a laughter peculiarly his own; and with it just that tang of occasional disapproval and dissent which seems to keep a nature from spoiling.

Dr. Bates' professional and related interests were numerous, but these did not prevent painstaking and thoroughness in his routine literary and professional tasks, nor did they hinder the special working over and working up of his lectures and lines of study till they could be not only genuinely but interestingly presented. His thought and planning were outward toward others, and he had deep satisfaction in presenting to others what had seemed to him so rich and well worth while. His joy in the whole round of his work was constant, and gave him a peculiar delight when again and again he could but feel that those to whom he was speaking fully responded. Honors came to him, reputation beyond his own school, his own city, his own region; and even that high, that coveted prize of acknowledged standing as a resourceful worker in his chosen field. And this reward was the more prized by him because of the up-hill struggle out of his early years, so meagre in training, not merely in the rudiments of education, but in that education of contact through their literary

legacy with great souls in generations past—what they thought, felt and strove for; what they sought out and made real for all time so that the future could never be as the past; the revelations of the microscope, the wonderland of biology, the advance of science in many fields. This realm he came at length to know and fully enjoy.

Dr. Bates was twice married: first in 1870 to Sarah Goodhue of Salem, who died in 1875. Two sons were the fruit of this marriage, one of whom died in infancy; the other, Henry Warren Bates, was born in 1873, and died in Auburndale in 1892. In 1881 Dr. Bates married Aroline Elizabeth Hodgkinson of Salem, Mass., his sole survivor. Called to bear keen sorrow and bitter disappointment, Dr. Bates yet found throughout his later years, in the sympathy and appreciation of the companion who shared his home, the rarest satisfactions home life can yield. Dr. Bates was a good citizen and helpful neighbor; he loved the life of today at its best. He was not snared by the outworn fashion of yesterday nor the jazz of the present time. For those profoundest values of life, nearer than one's breathing, more vital than the beating of the heart, which can neither be demonstrated nor adequately described, he gave full entertainment.

Death came to Dr. Bates in Cambridge, on January 5, 1925, in the very stress of work—suddenly, as he would have wished. At seventy-seven he had felt no numbing of the faculties, no halting of the step, nor any of the physical weaknesses which so often cast a shadow over later years; nor had he shown any lack of zest in living and working, nor any faltering in his sense of wonder at the ranges of the human spirit, and the marvel and beauty of the outer world.

INTERNATIONAL ASSOCIATION FOR DENTAL RESEARCH[1]

Scientific Proceedings of the Chicago Section[2]

November 17, 1927

EDWARD H. HATTON, B.L., M.D., *Editor*

Meeting held at the West Side Student Y.M.C.A. Building, Chicago, November 17, 1927. Chairman: Frederick B. Noyes, President of the Section.

Scientific program

I. Physiological movement of the teeth: considered from the histological viewpoint. *B. Orban*, M.D. 7
II. The regeneration of gum tissue following gingivectomy, with special reference to mitosis. *G. R. Lundquist*, D.D.S. 8
III. Regeneration of bone, peridental membrane, and cementum, following experimental injuries in dogs. *Burne O. Sippy*, M.S., D.D.S. 9
IV. Stereo-roentgenography, with special reference to orthodontic diagnosis. *L. R. Johnson*, M.S.D., D.D.S. 9

Abstracts

I. PHYSIOLOGICAL MOVEMENT OF THE TEETH: CONSIDERED FROM THE HISTOLOGICAL VIEWPOINT

B. Orban, M.D., Chicago College of Dental Surgery, Loyola University, Chicago

The histological evidences of tooth movement, in the bone of the alveolar process, are noteworthy. These observations deal only with

[1] A statement regarding the "organization and early development" of the International Association for Dental Research was published in the *Journal of Dental Research:* 1926, vi, p. 101. Abstracts of the papers presented at the general meetings, and at the meetings of the sections, since the organization (1920–27), are now being assembled for publication collectively in this *Journal*. The scientific proceedings of the meetings in 1927–28 will be published separately in this volume. See footnote 2.—[*Ed.*]

[2] The first of the statements of sectional proceedings in 1927–28. See footnote 1.—[*Ed.*]

the permanent teeth after they have come into occlusion, and are concerned with two types of movement. One, an occlusal movement of the teeth, is so marked as to incline one to the belief that tooth eruption is a continuous process. Three stages of this movement may be noted: the first, with only partial uncovering of the enamel cap; the second, with the enamel cap completely exposed; and the third, in which the clinical crown includes not only the whole anatomical crown, but also part of the root. Further evidence of this type of movement is seen in the distribution of bundle bone in the apical region, and in the presence of epithelial cords deep in the bone canal of this same region. In addition there is a gradual movement of the teeth mesially, to account for wear of the contact points. On the mesial aspects of the teeth, the bone of the cribriform plate of the socket is uniformly undergoing typical resorption; whereas on the distal aspect, new bone in the form of bundle bone is being produced to compensate for the loss of bone on the opposite side.

Frequent reference was made to the work of Gottlieb of Vienna.

II. THE REGENERATION OF GUM TISSUE FOLLOWING GINGIVECTOMY, WITH SPECIAL REFERENCE TO MITOSIS

G. R. Lundquist, D.D.S., Northwestern University Dental School, Chicago

The exact method of the regeneration of epithelium removed from the mucous membranes of the gingivae has been a matter of considerable discussion. By removing human teeth with the attached gum tissue, at various periods following resection of the crest of the gingivae, as is done in the treatment of pyorrhea, it has been possible to study regenerating epithelium.

From this material it is evident that the surgical defect is covered by an epithelial layer several cells deep pushing out from the margins of the incision. Nowhere does the covering consist of a single layer of cells. Mitotic figures are found not only in the basement layer, but also in the intermediate layer. The outer layer does not contain cells in mitosis. There is evidence, in the relative ages of the mitotic figures, that there is some movement of the dividing cells toward the periphery. As far as these specimens are concerned, cell division occurs only by the mitotic method.

III. REGENERATION OF BONE, PERIDENTAL MEMBRANE, AND CEMENTUM, FOLLOWING EXPERIMENTAL INJURIES IN DOGS

Burne O. Sippy, M.S., D.D.S., Dental School, University of Illinois, Chicago

When the injury is confined to the bone, peridental membrane, cementum, and dentine, and does not involve the pulp, the repair of the bone and peridental membrane is complete. These regenerated tissues are like the old tissues in all essential respects. A marked stage of resorption of the margins of the injuries in the cementum and dentine occurs before any regeneration takes place, and then the lost structures are replaced entirely by cementum of the osteoid type with enclosed cells (corpuscles) and typically embedded fibers of a new peridental membrane. Repair takes place alike in teeth with untouched pulps, and in teeth that have been rendered pulpless and the pulp canal filled with gutta percha.

Some of the material described at this meeting was presented in the *Dental Cosmos*, for August, 1927.

IV. STEREO-ROENTGENOGRAPHY, WITH SPECIAL REFERENCE TO ORTHODONTIC DIAGNOSIS

L. R. Johnson, M.S.D., D.D.S., Northwestern University Dental School, Chicago

The interpretation of x-ray films, viewed through any type of a stereoscope, is based on a proper understanding of the various factors that enter into the production and mounting of the films. In order to give these their proper consideration it is necessary that each step in the process be analyzed and studied.

From this series of experiments it is possible to conclude that, while this method of diagnosis is associated with an unusual number of difficulties both in technique and interpretation, yet it is a worthwhile addition to modern methods.

The methods and materials used in this particular series of films were then presented for comparison and study.

[The next succeeding scientific meeting of the Section was held on January 23, 1928.]

A SYMPOSIUM ON THE RELATION OF DENTISTRY TO THE PUBLIC WELFARE[1]

HERMAN E. S. CHAYES, D.D.S., *New York City;* AUGUSTUS S. DOWNING, M.A., PD.D., L.H.D., LL.D., *Albany, New York;* NORMAN HAPGOOD, M.A., LL.B., *New York City;* JAMES H. FURAY, B.A., *New York City*

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I. INTRODUCTION

HERMAN E. S. CHAYES, D.D.S., *President, First District Dental Society, State of New York*

It is with a rather mixed feeling that we greet you tonight on this our first meeting for the coming season of this Society. We have had the temerity to take a decidedly new step in so far as our regular meetings are concerned. Heretofore, we have been diligently engaged in listening to professional men talking to other professional men; it has been a matter of one of us telling all of us just what he thinks most of us should or should not do, and we have gone forth from this hall of learning and preyed upon the public in the light of our newly gained knowledge. Tonight it is just a little bit different. We are to be talked to by some of those who belong to the public, who speak for the public inasmuch as they are the public's public men. We are to be told what their impressions are of our doings. I hope this will go very far. I feel that I am justified in saying that their words will

[1] Addresses at a meeting of the First District Dental Society of the State of New York, New York Academy of Medicine, October 3, 1927. Each statement is a stenographic report as revised by the speaker.—[*Ed.*]

fall upon fertile ground because we as dentists, as professional men, trying to minister to the health of the public, are growing tired and weary in waging the usual kind of a fight with no usual end in sight.

Dentistry has been a profession for 100 years more or less, and during that time we have made tremendous strides in the development of technique used in repairing the damage that teeth have suffered. But with all our advancement in technique, with all of the new fangled ideas that are brought to us from time to time by our fellow-practitioners, with all our intensive work, with all the training we get at the schools, with all the post-graduate work we take—those of us who think have come to a realization that our efforts are all too futile, all too vain, all too inefficient to stem the tide of decay that is overtaking and destroying the health of the nation by the avenue of diseased mouths. And it is with the desire to get a greater vision of things, to be able perhaps to initiate interests sufficiently large so that bodies may be created who may teach us how to perform our dentistry before the tooth decays, that we have planned this meeting and the ones which are to follow. It is the desire to prevent those teeth from decaying that prompts us to try to enlist the ear, interest, and sympathy of the men who do the public's talking, with the hope that the ultimate goal will thus come to be realized all the more quickly.

I feel, personally, and I know that many of you feel likewise, that no matter how well our reparative work has been done, no matter how diligently we may fight these terrible diseases that have their initiating cause in decayed teeth, no matter if our numbers be doubled, trebled or quadrupled, we shall never be able to say that we are in the true sense of the word guardians of the public health until we liberate the public from the slavery of dental decay. That is my goal and I know there is many a heart in this audience which beats in sympathy with this desire.

I will never be satisfied as a member of this profession until I have seen institutions established where mothers can be guided through the period of gestation to bring forth children who shall carry teeth through life uncrowned by the horror of gold, unpierced by the drill of steel, and unbridged by the skill of man. And not until then can you and I and everyone of us feel that we are real public servants who have fulfilled our public duty. I conceive it to be the greatest goal

for the physician and the dentist to strive for—to make his share in the world's work unnecessary, to eliminate himself as a necessary cog in the machinery of the world. Now, this may sound Utopian, it may sound impossible, but it is not. If anybody had told you twenty-five years ago that you can take a piece of dead wire, roll it around a piece of dead paper, glue it with a little bit of dead shellac, have two dead ends extend from it, and then wire these dead ends to a transformer and a tube, and sit in New York and with a little bit of a dial tune in on a man talking in San Francisco, you would have said that was impossible, also. So you see twenty-five years is nothing in the scheme of things, it is in fact just a moment.

We are very fortunate tonight, most fortunate, in securing the co-operation of a man whose name is a household word in dental education. I know of no man who has ever worked in the cause of higher education who has earned and deservedly earned the gratitude of a profession as has our friend who is about to speak to us. He has been very kind to come to us to open this meeting, and I am going to ask you ladies and gentlemen for a rising vote of welcome to our friend, Dr. Augustus S. Downing.

II

AUGUSTUS S. DOWNING, M.A., PD.D., L.H.D., LL.D., *Lately Assistant Commissioner and Director of Professional Education, State of New York*

You know I am a retired public servant. The first of September most of you know—all my friends know, intimate friends—that I severed my connection with the State Department of Education; in other words, retired. But when Dr. Walker last spring asked me if I would come to this meeting, and gave me very briefly an outline of what the meetings of the First District Dental Society were to be during this year, and the purpose in mind—even knowing that I would not be connected with the State Department of Education—I told him I would be glad to come. While Assistant Commissioner for Higher Education I was charged with the responsibility of the administration of the dental law as well as other professional laws of the State, and charged with guiding as far as might be possible the course of study in the dental schools of this State, and the amendment of the laws, not

for the benefit of the dental profession alone, but primarily for the good of the public.

That was my duty, and through eighteen of those years, and over, I was bound by an oath of office to accomplish what might be accomplished through the agency of the great Department of Education of this Empire State. The program laid out by me in 1908 for the amendment of the laws and the betterment of education in the schools of medicine, dentistry, law, and so forth was completed in 1926 by the passage of the Medical Practice Act, as amended. With that program completed in its entirety, I felt that I might turn over the administration to someone else. So I became just a plain citizen of the great State of New York, my state of adoption, not to give up my interest in the profession, not to sit idly by and see the work of eighteen years crumble, but to stand always for that which I believe to be right, and for which you have given your support through all these years. My thought is that I as a citizen, a free lance, may now fight vigorously against the things that are wrong, and support as vigorously the things that are right.

Now, it seems to me tonight that this great First District Society is beginning, is taking a step, to show that it realizes that dentistry is more than a profession by which a man or a woman may earn a livelihood, but in addition it is an opportunity to give expression of what must be in the soul of every man and woman in the profession.

I noticed that the President used the word "satisfaction"—he would not be "satisfied" till a certain thing had been accomplished. I'd like to know whether there is any sane, serious-minded man or woman in this audience who has not more times than a few said to himself: "What is it all about? What is it that is worth-while that I am doing? What is life anyway that makes it worth while?" Speaking to one of the members of the Society this afternoon I asked him whether he had ever asked that question of himself, and he said: "I did it this morning. As I walked to my office I thought, 'Well, what is it all about, and what am I doing this for?'"

I have an answer for this question that is typical of what I think this organization means by this meeting tonight and by the program that has been laid out for the year. I heard a story the other day of a boy who took his first job in an industrial institution. Up to the

time that he went into this shop he had been perfectly free. He was eighteen years of age. He had gone where he pleased, done as he pleased, enjoyed life generally—as free as the birds of the air. Monday morning he had to be on time—eight o'clock in the morning. He worked until twelve, had an hour for lunch, and worked from one to five. Exacting work. He had put his head into a yoke. He had given up his freedom. He worked all week and when Saturday came they handed him his envelope. He opened it, took out the money, patted it, fondled it. It was the first money he had ever earned. And there was in his soul apparently, from the expression on his face, love of money. He put the envelope in his pocket and went home. He had a fine father and mother. He showed them the money, pleased beyond measure. He then put it away. He went to work the next week. At the end of the week the pay envelope was put in his hand. He opened it. This time he did not pat the money so fondly as he had the first week. Some of the joy and pleasure and affection was gone. But he took it home, showed it to his father and mother, but with not so much exuberance and joy as he had shown the week before. Sunday morning he said to his father: "If it were not for that pay envelope I don't think I would go to work tomorrow morning." Now, his father was worried over that because he did not want that boy to feel that money, the pay that he was getting for his service, the pay that was being given to him for giving up his freedom in life, was the ultimate goal toward which he wanted his son to strive. He said to him: "Well, Jack, what are you going to do with it now that you have got it? What are you going to do with it when you get more of it?" With great joy Jack said: "Why, Father, I am going to buy a violin." And his father was pleased. Now, what is a violin? Just some pieces of wood, a few thumb screws, a few pieces of gut, a bow, some horse hair. That is all there is to it. It was not the wood and the gut and the horse hair that that boy wanted, but it was an instrument by which he could let out of his soul the satisfaction that your president talks about accomplishing in his life.

So many young men think, who go into the dental schools, that it is a profession in which it is easy to earn money, quick money, large pay. They hear all kinds of stories about what men charge by the hour and

so on, and they see that they are going to be millionaires in just a few weeks. This Society tonight is undertaking to show to these young people, to this great city, the one to the other, that they want to do something else than fill teeth and make bridges and extract teeth and talk about the science underlying focal infection and so on; that they want to give expression of the spirit of the Society; that they want to do something for the public good for which they won't get a dollar, not a cent, but which will cost them time and money to accomplish.

If any of you read President Angell's address to the freshman class at Yale you will know as I know that he placed above everything else, health, as an asset for the student. It is very trite for me to say, or for anybody else to say because everybody knows it, but they never or almost never think about it, that the future of this great city and the future of this great State and the future of this great Nation primarily rests upon the health of the people. Given a sickly, weak body of men and women, you will get as a result a body impotent to govern the state.

Down in Atlanta, Georgia, every child in the city public schools from the kindergarten to the high school has as nearly perfect care of the teeth as it is possible for the Board of Education to give them. That grew out of the fact—and you can find this story in the last issue of the *American Magazine*, which gives a biographical sketch of the Superintendent of Schools in Atlanta—that there was an incorrigible boy in one of the classes. The Superintendent was absolutely opposed to expelling a boy or a girl from the school because it would deprive that individual of an opportunity. But this boy was so absolutely bad that the Superintendent finally acquiesced in the constant demand of the faculty of that school and said he would expel the boy. He sent for the boy to come to his office. He talked to the boy about the love of the boy's father, and the boy said: "You would not think so if you could see him." With that he stripped, and the boy was black and blue where he had been beaten by his father. While he was talking to the boy the Superintendent noticed that the teeth of the child were in an outrageous condition. He said: "Well, now Johnny, if you will promise to go with me to a dentist and have your teeth put in order— it will hurt—but if you will go with me and have your teeth put in order, I won't expel you for two weeks. I will give you another

chance." The boy said: "All right." He had begged the Superintendent not to put him out of school. He did not have any place to go. He said: "What would become of me?" (Did you ever think what is going to happen to these incorrigibles who are sent away to houses of correction and such places?) The Superintendent took the boy to a dentist and had his mouth put in order. The Superintendent said for several weeks he did not dare go near that school because he was afraid of the faculty. He mustered up courage one day to go in and see how the boy was doing. The boy was a new child. The faculty said he was a changed boy—"something has come over him."

I don't know but I believe that much of the criminality among youth—I think I know that much of the retardation and vagrancy among school children—is due to a wretched condition of the oral cavity. I hold that it is your duty as a Society, and that it is the duty of the Allied Council which has quite as many members as this First District Dental Society, to coöperate in bringing pressure to bear upon the people of this city and upon the men in power to use their influence so that the children of this city, like the children of Atlanta, may have their teeth properly taken care of—the children in the public schools at least. Proper care of the teeth is quite as vital to the public health of the people as medical care of the body.

George Eastman has done a great service for the City of Rochester. The children in the schools there, and in the city generally, who are so poor they can't have their teeth taken care of, go to the Dental Dispensary and have their treatment free. He has just established a similar institution in London. Is it not time for the First District Dental Society to wake up to the gratification of the soul that is inside every man that makes him want to do something for the good of his fellowman? My friends, all the philosophy of life is summed up in helping somebody else. Did you ever hear that? It is the only thing in life that is worth while. What is it all about? Why do you give your life to this and that? Is it the paltry dollar? You have to have it to live. Yes. That is all right. But that is not the goal. The goal after you get it and your own immediate wants are taken care of, if you have a dollar over, is to help somebody else go through life a little easier. "Cast your bread upon the waters."

I want to get into this First District Dental Society's soul tonight

that life is not the money that you get out of your profession, that life is not what enjoyment you get out of it selfishly, but that the only thing in life that is worth while is to help somebody else. You can impress the people of the City of New York that the health of its citizens, of its children, of its men and women, is the foundation needed to make this city the greatest city in the world—and that in order to have that they must not only have good physicians to cure the sick, but they must have good physicians to prevent them from becoming sick. They must not only have good dentists to repair defects in the oral cavity, but they must have good dentists who will give their lives to preventing decay and sickness and death. If you will do that, it will take time and it will take money. But my dear friends, after all your own soul is the thing that is worth saving. And as you minister to others, and make them healthy and well and keep them healthy and well, you have saved your own soul. And if you don't do these things for other people you have lost the satisfaction that your President talks about. You have lost the thing that was in the boy's soul that he wanted to let come out in the music. "And what shall it profit a man if he gain the whole world and lose his own soul."

Now, I have such confidence in the power of this organization, and such confidence in the altruism that there is in your souls, that I believe that this meeting and the next meeting and the next meeting will bear fruit, not only for the present but on down through the generations. I know that if you do these things, and do them right, some day or other the reward, whatever it may be, will be yours. But the great thing will be that you will be satisfied because you have done some good in the world for others, and because you have not lived a selfish life, solely for your own enjoyment.

May I tell you that it is a great pleasure for me to come to you. You helped me do my work as Assistant Commissioner of Education. This organization was always behind any progressive movement that I proposed. The State Dental Society had to be persuaded sometimes to do things they ought to do but they always got around and did them. So it is a great joy for me to come to you now, not as a public official asking anything of you, but to talk to you as a friend and to tell you that I am just as deeply interested for your sake in this movement

that you are starting tonight as though I were in a position to be of some official service to you.

III

NORMAN HAPGOOD, M.A., LL.B., *Formerly Editor of Collier's Weekly; One-time U. S. Ambassador to Denmark*

I am not at all sure that I can move in the moral atmosphere in which you have been moving under the guidance of your President and Dr. Downing. The thing that I expected to talk about in the main was how your profession and my profession by a certain course of action might take a large bunch of money away from a few very rich men.

Dr. Downing in the course of his inspirational remarks told about a boy who was a very bad boy until he got in the hands of the dentists, whereupon he became a very good boy. This recalls something I read in the newspapers only last June which showed a certain gentleman by the name of Al Smith coming down from Albany to New York, going to a dentist, and having five teeth taken out and five new teeth put in. I hope the effect on him — (Laughter).

I became acquainted with the importance of teeth in relation to greatness rather early in my career. I am not talking about Roosevelt —I am talking about George Washington. One of my early activities when I came to New York and began scuffling around, seeing if I could get enough money together honorably to pay the landlady, was writing a life of George Washington. And as I dug through the literature of the time I was struck by the different handicaps that very great man was under, growing out of the fact that his teeth were not good. It was a genuinely serious burden from his youth to the end of his life.

There are two definite, limited parts of the human system for which more had been done recently than in any other branch of human progress, outside of such purely mechanical things as engineering. One is the treatment of the teeth and the other is the treatment of the eyes.

I wrote another biography in those struggling days—one of Abraham Lincoln. As far as we know Lincoln's teeth gave him no great difficulty: his difficulty was with his eyes. If you go back not very

far in human history, people seem to have grown old much faster than they do today. Lincoln spoke of not running again for office when he was thirty-nine because he said "it is time for me to give the young men a chance." Today, of course, in high public office, thirty-nine is a young age. I don't believe that Charles William Eliot, for example—a good friend of mine, an inspiration to me through most of my life, whom I last visited and got both thought and knowledge from, when he was ninety-one and a half years old—could have kept his extraordinary vigor if he had faced the handicaps with his teeth that Washington faced, or with his eyes that Lincoln faced.

I have nothing to criticize in the dental profession. It seems to me one of the departments of life in which our progress has been so clear, so rapid and so immediately beneficial, that to celebrate its accomplishments is more to my taste than to criticize them. The suggestion I am going to make is anything but a criticism of dentists. The thing that remains to be done does not seem to me a thing that the dentists themselves ought to do, or are in a position to do. There are two aspects, I think, of the question that has been suggested to me that I talk about here tonight—about the relation of the teeth to general health. When we say that, do we mean the effect that the condition of the teeth has on general health, or do we mean the effect that the general health has on the teeth?

The first side of the question is going along rather satisfactorily. We are waking up the whole country pretty well, not as fast as we would like to—nothing ever happens quite as fast as we would like it to—but we are waking it up pretty well to the idea that if you produce poison in your mouth that poison is not going to stay in your mouth—that poison is going through your system. It may be rheumatism; it may be heart trouble. Something is going to result. That education is being carried on publicly by the United States Government, and by a certain number of states and cities. There are centers of activity that are spreading the idea everywhere. The business men are furnishing a great deal of money for spreading that doctrine. I dare say I am not the only one here who sees diagrams in the elevated railways and the subways showing just how many people out of five have pyorrhea. I suppose those people who make dental washes of various kinds, and advertise them widely and throw scares into the public, are

doing an extraordinary amount of good. It is possible they exaggerate. Even so, it is a wholesome lesson.

Before I pass on to the distinctly scientific part of my little talk I wish to mention one problem that I think anybody who goes to a dentist meets. I have been to dentists a good deal. It has always interested me to have my teeth kept in condition, because I am cowardly and do not like the idea of having them get enough out of condition to give me pain. There are two types of dentists, as there are two types of almost any branch of the medical profession. There is what I might call the type that has the specialist complex—the person who is tremendously interested in everything that can theoretically be done to improve the situation. If you go to an oculist, who is a specialist before he is a person of general human understanding, he is sure to find out that if you have corns or tooth ache or headache, or if you are a bad man, it is your eyes. He will want to do something to your eyes.

The dentist that I seek for myself is a thorough mechanic, who is enthusiastic about his work, who is an intelligent man, but who is not too much of a specialist; who is not going to try to get me to have everything done that he can conceive of being done. It is exactly the same as it is in the medical profession. Suppose my child is sick or I am sick. I don't go to a specialist to find out what is the matter with him. If I did go I should not believe what he said. I should know whatever kind of a specialist he was it would be that particular special trouble he would find. So what I do is to go to the best general practitioner I can find, the man who seems to me wisest and best informed and best balanced; and when I have thoroughly made up my mind that a certain thing has to be done, then it is time for a specialist.

When I move from one town to another, as I do a great deal, and choose a new dentist, I hunt for two things; a man who knows his job, and who also understands the profound truth that you don't want to find out in any situation how much could be done from a theoretically complete point of view, but how much is really necessary. Other people look upon it differently—customers are not all alike.

We have been touching on the question of what the teeth do to the general health of the body. The other side calls for serious attention from us at this particular time, with the prospect of good results. We

are all sure that some people in certain places with certain habits of life have on the whole good teeth. And in other places, with different habits of life, they don't have good teeth. We don't know much about the reasons, but we constantly make guesses. For example: all my life I have heard the negroes have better teeth than whites. I happen to be acquainted with a doctor who has a thoroughly scientific mind. About a year ago he had a vacation. He thought he would spend that vacation in seeing the West Indies, which he had not seen before, and while he was there he would have a chance to see dentists who were familiar with both blacks and whites, on account of the nature of the population. He went down there and talked with dentists working in the cities, and dentists working in the country districts. They told him they could not find a single bit of difference between the teeth of the blacks and the teeth of the whites.

The other day I heard of a gentleman recently back from Portugal. He brought back the news that the teeth of the people in the interior of Portugal were in good condition on the whole, and the state of the people who lived on the coast was bad. And contrasted with the general excellence of the teeth in the interior of Portugal the teeth of the Italians was much worse. That man brought back that information. It is a mere statement. There is no scientific basis for it. We don't know how many people he saw, we don't know what kind of observations he made, nor do we know anything about the living conditions either in the interior of Portugal or on the coast of Portugal.

I read only tonight something that was handed to me by one of my friends at the dinner preceding this meeting. It tells of a man, apparently well informed, reporting to a British learned society. He had been on a small island near Madeira. On that island he found the population eating practically no meat, practically no green vegetables, living almost entirely on a kind of soft mush which they did not chew, and the population had extraordinarily good teeth. He did not draw the conclusion that living exclusively on soft mush and not chewing it would give you good teeth. He drew the conclusion, without looking into it, without putting it to any scientific test, but simply from certain general indications, that it was probably something in the water—the amount of certain salts in the water.

I have a cousin eighty-two years old who drives in a little town in

Massachusetts—in a little cart with two wheels, and a horse. He has a long beard, and his name is Lyman Hapgood. I spoke to him the other day about his horse. I said: "How old is the horse?" He said: "Well, he will never see twenty-five again." I said: "He seems to be in pretty good condition." He said: "He is a good horse, but his system has been going back on him lately, because his teeth have not been good, and I have had to give him predigested food." That interested me a good deal, and I inquired around among some of the farmers whether it was not unusual for a horse to get to be twenty-five years old, and they said, no, if the horse was treated well in his youth, not worked too hard, and generally properly taken care of, that more often than not he would reach that age in good condition. They all said when he did begin to fail it was on account of his teeth. I had frequently heard the animals held up to man, as a contrast, in that they did not have this trouble of having their general health undermined by the decaying of their teeth. I have brought that out in argument once or twice in the last few days. It has been met with the statement that if these horses had been wild horses it was possible their teeth would have lasted them to the end of their lives, and would not have decayed any faster than the rest of their system. It is possible, but it again illustrates the fact that we don't know anything about it. We may say it sounds reasonable; but it is not science. It is not science, because we don't prove anything.

We have not found out one single thing about those influences in the general mode of life, in the general condition of the body, that make teeth decay. When I say "found out" I am speaking in scientific terms. What I propose as a definite object, for your profession and mine to work together on, is a simple method of getting a start in scientific investigation. There is too much money being given today for medical investigation as a whole.

The great discoveries of medical science have been made by men without equipment. When I was in Russia a few years ago I visited the greatest physiologist in the world. He had lived through the revolution, through the war before the revolution, and through the famine that followed the revolution. He had moved from the reasonable quarters that he had to a place that was smaller, where the

laboratory walls were not so high, because he did not have enough coal to keep himself warm, and the wonderful work had gone on just the same in the war, in the famine, in the small laboratory, as it had gone on before.

These big organizations do good, they do plenty of good, but when they get too much money something enters into their spirit that makes them more interested in equipment, in scrapping a laboratory that is perfectly good and building another laboratory that is just a little better, than there is in that striving of the spirit after new truths, which has been behind all of the really great discoveries that we have made. I believe that if these big organizations should be cut off for three years from any new funds it would be an actual benefit. That does not mean that some branches of their work do not need even more support. It is not my place to go into all those branches here, but it is relevant that this most important branch of the decay of the teeth, with its direct bearing on health, is not supported by these big funds at all.

Some people say it belongs to the dentists to do the scientific investigation. I do not see how in the nature of the problem it can be done by dentists. What is the problem? The problem is the effect of the whole system on the teeth. That is a general thing. That is not a problem that a person trained on the mouth particularly can handle. It is obvious that you must get a vast amount of information about the whole system and trace that to this specific point, rather than to reverse it. What could be done would be to apply the simplest methods of scientific investigation to the dental problem in this way: Appoint a commission. That commission goes to different parts of the world, wherever it gets information that the condition of the teeth is particularly bad or particularly good. Suppose it goes into Northern Africa where the Negroes are said to have particularly good teeth. It examines them, it notes every fact about how they live, what they eat, about the climate, about the water—a hundred different things. Then it hears that the teeth, we will say, in Northern Italy are particularly bad. It goes down there and does the same thing. It may be called up into Norway. After a while it has a lot of places with different kinds of tooth conditions and different influences, and after these have been sifted, after the facts have been com-

pared in the usual scientific way, you will have a number of problems put to you on which you can genuinely get to work. The work could be lessened by gathering ahead from consuls and other civil servants all that is now known.

I will give you one illustration of the need of talent in pursuing a research of this kind, and then I shall be about through. Probably there would have to be two branches to the investigation. It is a very special ability that is capable of going into an entirely new situation and keeping itself fully open to the truth. The ordinary mind, the commonplace mind, is looking for certain things. It is looking for water. It is looking for diet. It is looking for climate. It finds what it is looking for. It does not find the unknown thing that may be the real answer. You have all heard of beriberi. That was a disease that in certain parts of the world, notably Asia, was creating great ravages. People naturally wanted to know what caused it. After a while they found a fact that seemed to them conclusive. Beriberi was found near the water. It was found along the coasts, by the ports. It was found along the banks of the great rivers. But if you got away from the water, off into the interior, nobody had beriberi. They said: "Obviously, it is diet. These people along the coast, or along the rivers, are eating fish, and the others are not." One day there was a Dutchman down in Malta feeding some chickens. He had been feeding those chickens on natural rice, rice in which the whole grain was ground up together. By a sheer chance, some white rice, "polished rice" as we call it, came into his possession and he fed it to the chickens, and they got a sort of chicken equivalent of beriberi. They had certain symptoms resembling those that human beings have in beriberi. Being of an inquiring turn of mind he then proceeded to feed them these two diets alternately, and they had the sickness every time they had the white rice, but did not have it at all when they had the other kind of rice. The mistake in selecting the cause had been made because the white rice, sent to Asia from Europe, was found only near the ports.

If you can get public interest enough to attract the attention of one of the big foundations to the purely scientific side of this question, to the fact that a few hundred thousand dollars (at the utmost a couple of million dollars), would lay the foundation for genuine knowledge

in a field where we are now dependent on guess work, that a simple investigation into dental geography would launch us at once into new fields of progress with immediate influence on every family in the world —on its health, happiness and efficiency—then I cannot believe it would be many months before the sum necessary for such a start would be forthcoming.

IV

JAMES H. FURAY, B.A., *President of the United Press*

I feel sure that all the gentlemen of the dental profession here present will understand rather clearly that it is not very easy for a newspaper man, a layman, to address a gathering of experts in the dental profession. Not long ago I saw a cartoon of a rather irrepressibly comic character, "Skippy" saying his prayers. "O, Lord," he said, "give me the strength to brush my teeth every night. But if I make a mess of it, O, Lord, give me the strength not to worry about them." I don't mind saying to you that I would not have much difficulty naming a certain newspaper man who has felt very strongly inclined to join Skippy in prayer and say fervently: "O, Lord, give me strength to address this gathering of dentists coherently, and if I make a mess of it, O, Lord, give me strength not to worry about it."

The viewpoint of the layman on the problems confronting the profession of dentistry is, of course, the viewpoint of a person who is on what you might call the receiving end. But after all, there is nobody to whom the solution of these problems is more important than the layman. He is the one who will benefit most by their solution. Indeed, the measure of success in solving the problems is the measure of the benefit to the layman. Consequently, even if the layman has no clear point of view in the matter, and usually he has not because of complete unfamiliarity with the highly technical and exceedingly complex subject—even if he has no point of view, he must have a very definite interest if he consults his own physical well-being. Unfortunately, this aspect of the matter is too often overlooked, for we layman go along blithely in our various ways without giving a thought to a thing which concerns each of us rather vitally. We all know the saying: "Every time he opened his mouth he put his foot

in it." It is almost true that every time we open our mouths something goes into them, and it is difficult for anything to enter our mouths without coming in contact with the teeth, and right there is where dentistry begins.

Those of us who have been so unfortunate as to have trouble with our teeth—and who has not?—may have been indifferent to the warnings of our dentists during the rather blessed days of ease and comfort, but our indifference vanished the instant the warning of pain appeared. Usually this is the cause of the first experience of laymen with you ladies and gentlemen here. We are thinking mainly of comfort and as soon as we are uncomfortable we discover that, after all, dentists are pretty useful folks. How many laymen think of the possibilities of benefit to us *before* we are called upon to bear physical pain. How many of us recognize what a profound influence the teeth have not alone on our immediate comfort, but upon our immediate and future general health. When I was a boy—and that was not so terribly long ago—it was generally believed among laymen that it was foolish to go to a dentist excepting to have teeth extracted or to have them filled or to have them straightened. There were a few, no doubt, even in those dark ages, who appreciated the influence of proper care of the teeth upon the general health, who had the vision to see, what it seems now should have been obvious to all even then, that the very functions of the teeth necessarily affect the digestive apparatus for one thing and, through that, the whole well-being of the man. But there were very few; and that was long before it was commonly known and accepted as a fact that the condition of the teeth often directly causes many human ills and human diseases. In those days we laymen generally regarded it as an inevitable fate that we were going to lose our teeth when we reached a certain age. We had a kind of fatalistic point of view. When a man was a youngster he probably had very good teeth. If they began to ache he stood it as long as he could and then had the offending teeth extracted. He heaved a sigh of relief and was glad that was over. When he approached the age of fifty his teeth just naturally began to disappear and there was nothing anybody could do about it.

It was in those days that dentistry began to build and develop from a teeth extracting and teeth filling and teeth replacing craft to a great

science, and to a great profession striving for the knowledge which would enable it to achieve the ideal of preventive dentistry. It was in those days that dentistry began to go below the surface of things and get to the root of the causes, and in this way to study not alone those dental defects and their causes for the purpose of removing their ill effects upon the general health, but also to study the causes which brought dental defects in order to prevent them.

This is a high ideal and its achievement is obviously of the utmost importance to the layman. Despite the great strides forward that dentistry has made since those dark ages to which I refer, it is a fact, I believe—at least I so understand—that many great problems relating to dentistry are still unsolved; not only unsolved, but only vaguely comprehended. In some cases, I understand, it is not yet commonly admitted that they are problems with which dentistry alone should cope. Only increased knowledge of facts, or at least of probabilities, will bring a solution of these problems. It is impossible properly to cope with something you do not really comprehend. The first requisite, therefore, is as Mr. Hapgood pointed out, more and more knowledge, more and more information, more and more established facts about the whole question of teeth, the diseases which affect them, and above all, the troubles which are revealed in the teeth, but whose most serious manifestations are in the whole system.

To a layman, knowing nothing of these great problems with which the best minds of the profession are coping, it would appear that the great need of the hour for dentistry is the need for research work of the most profound and searching kind. Pure reason will go far in solving any problem, but pure reason can do little unless it has established facts to work on; and these cannot be produced except by constant, untiring, never ending investigation, inquiry, and examination. When the police have a dangerous murderer to deal with, they don't sit down and try to reason out without facts where he is hiding. They investigate every smallest bit of information they can get about his haunts, his habits, his physical appearance, etc. It is the job of the police to find that man and to check his career. And after all, is it not the job of the profession of dentistry today to do just that? There is a villain at large. He may be merely a poisoner, he may be a murderer, but he is a villain and an enemy to society. He is that

something which causes decay of teeth, the affections of the mouth and the other things which are readily revealed to you experts in such matters. But above all he is that something which works twenty-four hours a day to break down the general health of man and leaves his mark in the mouths of his victims. You are the policemen who must find and run down that villain, and your detectives will be the men who will devote their great knowledge and their great skill to acquiring greater knowledge and greater skill so that mankind may be benefited. This is a tremendous work and, it seems to me, a tremendous responsibility.

I admit that I was very much astonished to hear that the facilities for research work in dentistry are comparatively few, that there is scarcely any such thing in our great universities as research departments in dentistry such as exist in medicine and other scientific professions. In keeping with the importance to mankind in general of the results of such research work, it would appear that there is a very great need of the most elaborate and the most thoroughgoing research foundation to enable the profession of dentistry to learn all the things with which it must cope. On the surface it would appear that the responsibility for this situation rests entirely on the dental profession itself, but I think it is by no means certain that this is a fact. No doubt, there are thousands of dental surgeons of the highest attainment, and of the highest ideals of service, who are only awaiting the opportunity to give their great skill and their great knowledge to the service of humanity. They would embrace that opportunity with enthusiasm, I have no doubt. But where is the opportunity to come from? Evidently, the answer is that it should come from the greatest beneficiary of the results of such research work, the public. I have no doubt that it will come, but it appears to me to be a matter of education and of a clearer understanding by the man in the street that science in dentistry as in other professions cannot always pull itself up by its own boot straps. I believe that, once fully aware and convinced of the great good which could be accomplished by such research work, the general public would support that need. It is for you members of the profession to visualize it and bring it into being through the aid of that public.

All of this seems a long, long way from gathering the news of the

world and getting out newspapers, which I understand is supposed to constitute the business of a newspaper man. But this matter does affect newspapers, and newspaper men after all. Newspaper men naturally and modestly, I hope, regard their profession as the greatest of all because, in a sense, it is all inclusive. Everything in the world which affects human activity is of interest to the newspaper and to the newspaper man. And this is particularly so in matters which mean progress to human society and improvement of the health of the common man. I have no doubt that the press generally would support such research work in dentistry as we are told is obviously needed, just as it will always support any worthy cause tending to the common good. I am told there are about 50,000 practising dentists in this country. We take it for granted that all of those privileged to serve in the profession of dentistry are alive to the needs of the hour. We take it for granted that over and above all their labor is always the great ideal of service to humanity, to discover the causes of human ills as far as they can do so, and to root out those causes for the benefit of mankind. And we believe that such a body of men united in a common purpose of benevolence can achieve much in educating the public to the need of greater and greater research work.

If an expression of opinion by a layman is of any value, or is acceptable, I should like to say that the effort on the part of this Society to stimulate an interest in dental research is commendable, and I should like to offer congratulations to the Society and to express the hope that its efforts in this respect will be widely and quickly recognized. It was Dante who said: "Give light and the people will find their own way." It seems to me the need of the day in dentistry, as in many other sciences, is light, more light.

TRIGEMINAL NEURALGIA AND ITS TREATMENT[1]

K. WINFIELD NEY, M.D.

Professor of Neurosurgery, New York Polyclinic Medical School and Hospital

Although tic douloureux has been recognized as a distinct clinical entity for more than 120 years, its etiology remains obscure and its pathology undetermined. The paroxysmal character of the sharp, lancinating facial pain is so characteristic of this distressing malady that there is usually but little difficulty in making a positive diagnosis based alone upon the patient's description of the pain. There are, however, several painful affections involving the trigeminal area which are not typical paroxysmal trigeminal neuralgias and which must be carefully differentiated from the true case. It is not uncommon to find in the course of a migraine that most of the pain is located in the trigeminal area, often in the region of the first division, but there should be no difficulty in differentiating an attack of migraine, which is periodic in its recurrence and usually having a gradual onset, increasing in severity, reaching a climax, and fading away after a period of pain and discomfort lasting 12 to 48 hours. The pain of migraine, commonly known as "periodic sick headache," is usually dull rather than sharp, and described as throbbing. The facial pain that occurs in disease of the accessory sinues, in sphenopalatine neuralgia, and various other disorders of the face, gums and teeth, may suggest trigeminal neuralgia, but a careful consideration of the pain characteristics will usually serve to differentiate definitely the atypical form of facial pain from that of the typical trigeminal neuralgia.

The pain of paroxysmal trigeminal neuralgia is severe and essentially short; it is distinctly paroxysmal in character, striking the patient

[1] Read at a meeting of the First District Dental Society of the State of New York, New York Academy of Medicine, December 3, 1925. The paper, without the discussion, has since been published in the *Journal of the Medical Society of New Jersey*, 1926, xxiii, p. 22.

without warning. A paroxysm usually lasts a few seconds and rarely longer than a few minutes. It is characterized by patients as being excruciating, as though the face were being penetrated by a "hot iron," or "jagged lightning." It is commonly described as burning, boring, cutting, piercing, like the touching of an exposed nerve of a tooth. While a single paroxysm lasts usually but a few seconds, frequent repetition of these shocks may occur during an attack. The attacks of trigeminal neuralgia may be separated by an interval of months or even years. Occasionally an attack may last for a few days or weeks, after which the neuralgic pains may not again be felt for a period of weeks or months. Often, however, there is but little intermission between attacks, and the patient has a series of daily paroxysms for months, and occasionally patients who apply for relief have had these excruciating paroxysms of pain daily, or many times each day, for years.

The course of a paroxysmal trigeminal neuralgia is essentially chronic. The disease, at first usually limited to a single division of the trigeminal nerve, tends toward a progressive involvement of other branches. The pain is usually referred to the periphery, and commonly involves the angle of the mouth, the upper or lower lip, or the ala of the nose. In these areas, the touching of the skin is often sufficient to induce a paroxysm of pain, and hence they have been termed by Patrick "dolorogenetic zones." Occasionally such a zone may be located in the tongue, in the buccal membrane, or in a single tooth. In many patients, any irritation of a dolorogenetic zone will produce a characteristic paroxysmal pain, and a patient with true trigeminal neuralgia is usually very reluctant to permit the examiner to touch this zone, for fear of precipitating an attack. These patients live in almost constant dread of inducing an attack, which may be instigated by washing the face, shaving, or stroking the beard, drinking cold liquids, and occasionally even the taking of food.

More than 70 per cent of patients reporting for treatment have had all their teeth extracted from the affected side. Many have been mutilated by ill-advised operations on their sinuses and gums by physicians and dentists who fail to appreciate the clinical aspects of the affliction. I have never seen a case of true paroxysmal trigeminal

neuralgia relieved by any operation upon the teeth or sinuses, nor is the condition influenced by the use of medication. The only hope of relief in typical cases lies in the surgery of the trigeminal tract.

The surgical procedures in general use consist in: alcoholic injections of the terminal branches or the gasserian ganglion; either division or avulsion of the peripheral branches of the trigeminal trunk, or the posterior root of the ganglion. While alcoholic injections of the supra-orbital, infra-orbital, and third division of the trigeminal nerve, when successfully accomplished, may give relief for 1 or 2 years, and occasionally longer (though rarely so), the procedure must be repeated with less satisfactory results. It is only in exceptional cases that the relief obtained by alcoholic injections is permanent, and sooner or later the unhappy victim is driven to seek relief through the more radical operation of division of the sensory root of the ganglion. Peripheral operations upon branches of the trigeminal nerve give relief only until nerve regeneration takes place, after which the patient is again subjected to the tortures of the attack. Attempts at alcoholic injection of the ganglion through the foramen rotundum are successful in about one-third of the cases, but the relief here is usually only transient; and the injection is so commonly fraught with serious complications that it is being largely abandoned in favor of root division.

The division of the sensory portion of the posterior root of the gasserian ganglion is by all means the operation of choice. With experience and perfection of technic, the mortality of this procedure has been reduced to less than 0.5 per cent, and by this procedure in typical cases we can promise a complete and permanent relief of pain. In our experience, patients so treated regret their wasted time in trying to procure permanent relief from alcoholic injections and peripheral resections. Even in the aged, and those afflicted with cardiac or renal disease to an extent contraindicating general anesthesia, division of the posterior root can be very satisfactorily accomplished under local anesthesia; in fact, in the majority of instances we find that under local anesthesia and with the patient in a sitting posture, the complete operation may be effected in less than an hour, entirely without pain, with a minimum loss of blood and totally without shock. In patients who are very nervous and do not wish to be

operated on without being put to sleep, it is our practice to use rectal oil-ether anesthesia, which makes the patient drowsy or induces light sleep; the operation is then done under local analgesia. With this method of anesthesia, the marked venous oozing so commonly encountered in gasserian work, resulting from the cerebral congestion of an inhalation anesthesia, is largely eliminated, and it is possible to complete the operation in a much shorter time—often our local anesthesia cases are completed in less than 45 minutes.

The surgical treatment of trigeminal neuralgia, whether it be alcoholic injection, avulsion, or resection of the posterior root, invariably results in a cutaneous anesthesia of the affected side. Unless this anesthesia is produced, the beneficial effects of the treatment are not experienced. To the patient the operation resolves itself into an acceptance of cutaneous anesthesia for loss of pain. The numbness of the anesthetic region of the face annoys some patients until they become accustomed to its presence. Usually a few months is sufficient, and patients with true paroxysmal trigeminal neuralgia are always grateful to exchange their pain for an anesthesia.

With the perfection of the technic of posterior root division, it seemed that the question of trigeminal neuralgia was solved, yet experience has proved that even this procedure might be refined by preserving the motor root of the trigeminus, which may in most instances be satisfactorily isolated—thereby preserving the function of the masseter, temporal and pterygoid muscles of that side. This is of particular importance in those rare cases in which the patient is the unhappy victim of a bilateral trigeminal neuralgia.

In a small percentage of cases, trophic disturbances in the cornea occur, and after all due precautions we have observed minor corneal abrasions in about 4 per cent, though less than 1 per cent have actually developed corneal opacities. Spiller and Frazier have pointed out that in the posterior root of the ganglion the fiber bundles are arranged in groups, corresponding in function to the terminal divisions of the trigeminus, and that it is possible to divide the outer two-thirds of the posterior root and preserve sensation in the cornea and the first division of the nerve. Inasmuch as the majority of cases of trigeminal neuralgia are limited to the second and third divisions, the subtotal resection of the posterior root seems to relieve

completely the neuralgia and at the same time preserves corneal sensation, thereby preventing the possibility of corneal trophic changes. In doing this operation under local anesthesia, we have repeatedly demonstrated the feasibility of this procedure; by dividing a portion of the root, and having the coöperation of the patient, we have been able to determine the exact location of the anesthesia produced. In dividing the bundles of the trigeminal root from without inward, division of the first bundles produces an anesthesia of the chin and lower lip; with the progressive division of bundles medially, the area of anesthesia is raised until the eye is approached, thus demonstrating clearly the position of the bundles in relation to the ganglion and its peripheral divisions. In those patients who suffer from involvement of the first and second division of the trigeminus, it seems advisable to divide the entire root, making no attempt to preserve corneal sensation.

While in typical cases of paroxysmal trigeminal neuralgia, the relief obtained from division of the sensory root of the ganglion is certain and permanent, this procedure does not serve to relieve other disorders in which pain is expressed in the trigeminal area, and it is the experience of most neurologic surgeons to have operated on certain atypical cases which were not true paroxysmal trigeminal neuralgias, and failed to relieve the pain. These unfortunate experiences with atypical cases have been exceedingly helpful in the clinical identification of types, though in some instances we may still have difficulty in differentiating certain forms of facial pain which more or less simulate the typical clinical expression of the malady. Any type of facial pain which crosses the mid-line of the face or radiates beyond the trigeminal area, or which is attended with objective symptoms such as anesthesia or facial paralysis, and most cases in which a paroxysm lasts longer than a few minutes, should be considered as doubtful, even though the pain appears to be largely confined to a definite trigeminal area. Midfacial neuralgias of the sphenopalatine type may occasionally bear some of the characteristics of trigeminal afflictions, but they may be differentiated in that they are relieved by anesthetizing the mucous membrane of the nose in the posterior middle turbinate region. Tumors of the posterior fossa and of the gasserian ganglion rarely give typical attacks and are invariably

associated with more or less organic disturbance with objective signs, which immediately suggests the nature of the lesion. Attacks of migraine are commonly confused with trigeminal neuralgia, and are to be differentiated by their regular periodicity, the length of the attack, and the throbbing nature of the pain, which progressively increases and decreases. Various other disturbances giving pain in the trigeminal area are little understood and can be but indefinitely classified at the present time; certain of these are undoubtedly due to disturbance of the sympathetic system. We have seen two instances of painful afflictions of the face, upon which the posterior root of the trigeminus had been previously divided, yet the patient continued to have a more or less constant burning pain in the anesthetic area. Both of these cases were eventually entirely relieved through resection of the superior cervical sympathetic ganglion and a decortication of the internal carotid artery.

When there is doubt regarding the nature of a facial neuralgia, particularly if it involves the area of the second or third trigeminal division, the diagnosis might be helped by alcoholic injections of these divisions at the foramen rotundum or ovale. If there follows a complete anesthesia in the cutaneous area of the branch injected, and the neuralgia is entirely relieved and remains relieved as long as the anesthesia persists, the condition can be reasonably considered as being a true trigeminal neuralgia. When, however, the pain persists in the anesthetized area after an alcoholic injection, the surgeon may conclude that the case is not a trigeminal affair.

Reiteration of salient points:

(1) Typical paroxysmal trigeminal neuralgia is a disease characterized by a distinctive symptomatology, which is not to be confused with other expressions of facial pain occurring in the trigeminal area.

(2) Paroxysmal trigeminal neuralgia is never cured by the use of drugs, operations upon the sinuses or teeth, and in most instances is but temporarily relieved by alcoholc injections and operations upon the peripheral branches of the ganglion.

(3) Typical cases of trigeminal neuralgia are completely and permanently relieved by dividing the posterior root of the gasserian ganglion, which can be safely and easily accomplished under local anesthesia by an experienced neurosurgeon.

(4) In obtaining relief for trigeminal neuralgia, the patient gratefully exchanges his paroxysmal pain for a permanent cutaneous anesthesia of the affected side of the face, nose, mouth and tongue, to which he usually becomes adjusted in a relatively short time.

(5) In most instances, it is possible to preserve the motor root, thereby retaining function in the masseter, temporal and pterygoid muscles of the affected side.

(6) Under local anesthesia, it is quite a simple procedure to resect bundles of the posterior root of the ganglion progressively from without inward, raising the level of the anesthesia from the chin upward until the lower eyelid is reached, preserving corneal sensation. It is also possible, beginning on the medial aspect of the root progressively to resect the fibers outwardly, lowering the area of forehead anesthesia until the upper eyelid is reached, thereby effecting an almost complete division of the posterior root, retaining only those fibers subserving corneal sensation.

(7) Subtotal resections of the posterior root give very satisfactory results, when anesthesia is produced over the second and third divisions of the nerve, preserving corneal sensation, which, when sacrificed, subjects the patient, in a small percentage of cases, to certain trophic disturbances which occasionally lead to permanent corneal opacities.

(8) A certain type of pain in the trigeminal area, characterized by a more or less continual burning sensation, is relieved by resection of the cervical sympathetic.

140 West 57th Street

DISCUSSION

Theodor Blum, D.D.S., M.D., F.A.C.D. (New York City): That the knowledge and information I received in both medical and dental schools, regarding trigeminal neuralgia, was not in accord with our present understanding of this malady can easily be seen by reading my article written in 1911.[2] At present nothing is known of the etiology of this neuralgia except that most likely it is of central origin. The sympathetic system

[2] Blum: Causes and surgical treatment of trifacial neuralgia, *Therapeutic Gazette*, July 15, 1911.

may also be a factor. To use Frazier's own words: "There is nothing obscure about trigeminal neuralgia save its origin."[3]

In the diagnosis of trifacial neuralgia one is aided by its typical symptomatology. Atypical cases, also termed facial pains, often strongly simulate a typical neuralgia, and lead to mistakes in diagnosis, which have been made by inexperienced practitioners only, and mostly in cases of cerebral tumors accompanied by sensations of pain in the trigeminal area. A patient at times makes his own diagnosis as in the following instance: A patient apparently suffering with trifacial neuralgia was referred to Dr. Frazier for operation or alcohol injection. A diagnosis of a more or less atypical form of neuralgia was made, and, on account of the patient's extreme suffering, it was decided to inject alcohol. Fortunately, Dr. Frazier was called out of town and had to postpone the injection for twenty-four hours. Upon his return, he found that the patient had left the hospital, having been unwilling to wait for him. This confirmed the previous diagnosis, namely, that the patient was not suffering with tic douloureux, that her pain was functional in origin, and that there was also a psychoneurosis present. Dr. Frazier continues: "I have never in my entire experience seen a patient with trigeminal neuralgia who fled from a hospital before treatment could be applied, and I am glad that the patient should have diagnosed her own case before I had a chance to inject any alcohol."

In another instance, I was asked over the phone to see a patient who, for the last few days, had been suffering supposedly from a very severe supraorbital neuralgia, for which a neurologist had injected alcohol into the supraorbital foramen without giving the patient relief. Roentgen examination of her maxilla disclosed the presence of a malposed canine and no other pathological evidence. Apparently examination by an internist, the family physician, the neurologist, and dentist, did not throw any light upon this case. I refused on two consecutive days to operate on the patient for the removal of the malposed canine, which was considered the causative factor. A New York neurologist who finally examined the patient made the diagnosis of encephalitis. The patient died the next day.

It must be emphasized that peripheral operations never permanently relieve a true case of trifacial neuralgia, the only permanent cure being the subtotal section of the sensory root. It may be of interest to mention here the case of a dentist suffering with trifacial neuralgia who,

[3] Frazier: A surgeon's impression of trigeminal neuralgia, *Journal of the American Medical Association*, May 11, 1918.

during my student days, was an inmate at Blockley Hospital in Philadelphia. I believe there were altogether seventeen operations, including, as reported, the removal of the gasserian ganglion by W. W. Keene. Even this "radical operation" did not relieve him. However, when studying the records of this case, while writing the previously mentioned paper, I found that the removed tissue had been examined by Dr. Spiller and that no ganglionic tissue was found microscopically, showing that the ganglion had not been removed.

It is well to remember that cases of atypical neuralgia get worse after operations for local trouble about the teeth and jaws. Frazier and Russell recommend "sympathectomy of the superior cervical sympathetic ganglion, and stripping of the periarterial sympathetic plexus of the common carotid artery, in cases of burning sensation in the gums, sensation of pins and needles in the face, and a burning sensation in the cheek below the eye."[4] I have seen many cases of this type who are really suffering and where co-operation with the neurologist and neurosurgeon is or should be extremely helpful to the patient.

These operations being distinctly in the field of the neurosurgeon, it remains the duty of the oral surgeon only to exclude the mouth as a possible factor because there is always a possibility of mistake in diagnosis. The oral cavity must be put into normal condition. To accomplish this, a complete roentgen examination, pulp test, and sinus plates must be added to the routine examination of the teeth, jaws, and surrounding tissues. The neurologist's examination will confirm the diagnosis and the operation is performed by the neurosurgeon.

The paper of the essayist has completely covered the ground and does not permit disagreement. It was therefore only possible for me to call special attention to the duty of the oral surgeon in these cases and to emphasize some points of special importance.

Henry Sage Dunning, D.D.S., M.D. (New York City): This paper, which has given me a great deal of pleasure, is a very timely one to present before a dental society. The dentist is often called upon to eliminate vague pains about the face and jaws, and I feel there is usually too much guesswork about it. I wish to congratulate Dr. Ney upon his excellent paper, and upon the clarity with which he has dealt with this subject, which is a very difficult one to grasp, and about which we know very little.

I wish we could include in the curriculum in the dental school a prac-

[4] Frazier and Russell: Neuralgia of the face, *Archives of Neurology and Psychiatry*, May, 1924.

tical course in neurology or neural surgery, so that the dentist might learn more about the nervous system. I know very little about it, and most of these cases I send to a good neurologist to check up the lesion and make a diagnosis. In the cases sent to me primarily, I ask the neurologist if I can be of aid to him in eliminating possible oral factors which could contribute to the condition. I believe it would be a good thing to have a practical course in neurological surgery in the dental schools, so that we would have a working knowledge of the important nerves which we are called upon to treat as dental specialists. It is impossible, as a rule, for the dental surgeon to locate and to find out to his and the patient's satisfaction where the short circuit exists; we are living in a tremendous age, and are more highly organized than we were some years ago. People are continually coming to our offices complaining of vague pains, many of them real, and some not so real, and we are asked to take out teeth and perform minor operations around the jaws which I think, as Dr. Ney does, often do more harm than good.

I made a notation as to scars. Taking out tissue and taking out teeth, and thereby leaving scar tissue, I think does more harm than good. We should not leave something which may press on and continually irritate nerves that are locked up in bony cavities and therefore cannot escape from such pressure. I refer especially to the inferior dental nerve.

I believe very often the dental surgeon cannot make an accurate diagnosis in these cases, and there is accordingly too much guesswork. It would be a good thing if we could make an early diagnosis and get these people "routed," as they said in the army, to the proper specialist and say to the patient: "I do not know what is the matter with you, and I cannot tell you whether taking out that molar will help you." The oral surgeon should send these people to a neurologist for an opinion, asking if he can help him in eliminating any possible cause. But the practice has been the other way, and a lot of people have had their teeth extracted because the dentist feels "there must be something there," and he keeps "going down the line" and taking out useful teeth and carving useful bone. The dentist should coöperate with the neurological surgeon in nearly all cases of vague pain.

Dr. Ney says that in true trigeminal neuralgia the second and third division are mainly involved. I agree with that, and it may be due to the fact that these large sensory nerves are locked up in bony canals, and are irritated and traumatized more than the first division or the ophthalmic division. Many teeth are infected, and become diseased and are tampered with and treated many times, and then taken out and the bone curetted.

Scar tissue forms and a sclerotic condition ensues, and those nerves are locked up in bony canals with sclerotic walls. And in taking out those nerves, which I have frequently done, I find that many of them present a true neuritis, and true neuritis spreads to other branches, as Dr. Ney has said. You may have an irritation in the third division, have the tooth removed, and a neuritis sets in. A true inflammation of the nerve has been established, and spreads to the other branches—the first and second —and there is a true neuralgia which Dr. Ney has so well described. Then nothing will help the patient but surgery.

Alcoholic injections are more or less in the discard, and most people would rather have a serious operation, which for all time would relieve their misery, than perhaps be injected three or four times, which is in itself a painful operation, and does not completely relieve them.

If we could make an early diagnosis, and alleviate the pain, and relieve the patients of their intense suffering, it would be of great benefit to us all. I agree absolutely with Dr. Ney that drugs and other medication do not touch this condition at all. It is a waste of time, and it is generally caused by the "stalling" of the doctor, or the lack of courage of the patient, or the failure of the patient to get into proper hands.

PRELIMINARY REPORT OF THE COMMISSION ON MEDICAL EDUCATION[1]

Quotations of Special Significance for Students of Dental Education

Selected by WILLIAM J. GIES

Columbia University, New York City

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PREFATORY NOTE BY THE COMPILER

The preliminary findings of the Commission on Medical Education foreshadow important developments in medicine. Although many of the Commission's views are applicable to conditions in dentistry, dental journals have failed to publish them. These quotations from

[1] [Published by the Commission, 1927; pp. 90, without index (text, pp. 1–58; appendix, pp. 59–90). *Members of the Commission;* A. Lawrence Lowell, *Chairman;* Walter L. Bierring, George Blumer, Hugh Cabot, Samuel P. Capen, William Darrach, David L. Edsall, Sir Robert Falconer, Henry G. Gale, Michael F. Guyer, Walter A. Jessup, Lafayette B. Mendel, William Allen Pusey, Olin West, Ray Lyman Wilbur, Hans Zinsser, Willard C. Rappleye, *Director of the Study;* Fred C. Zapffe, *Treasurer.* The members of the Commission, selected by a committee of the Association of American Medical Colleges to conduct a thorough study of medical education, represent "general education, the basic sciences, clinical teaching, public health, the medical profession and medical licensure, and . . . . began to function in the fall of 1925."]

the "Preliminary Report" not only embody its spirit, but also summarize facts and opinions of special significance for dentists.

The import of the quotations being obvious, they are presented with very little supplementary comment, which appears in footnotes enclosed in brackets. The pages of the Report on which the quotations may be found are indicated by suitable references.

INTRODUCTION

While these [professional and statutory] regulations have been largely responsible for the high character of medical training, they have led to much rigidity which is now widely believed to be undesirable and confining to an extent which handicaps the application of sound methods of education. [Page 8.]

These matters [of regulation] have been discussed frequently at the educational meetings of the American Medical Association, of the Association of American Medical Colleges, and of the Federation of State Medical Boards. The opinion in these bodies has been one of growing dissatisfaction with the present situation. A number of medical schools are university divisions and others are in the process of becoming so, and there is a growing unwillingness on the part of the universities and educational bodies concerned to approve or apply further regulations until some of the present confusion is clarified, although it is believed that important changes are desirable. [Page 8.]

Every attempt is being made to correlate medical education with general education upon which it is dependent, on the one hand, and with the shifting community health needs, to meet which the student should be prepared, on the other. Medical education stands between general education and the specific demands of medical service, and obviously should not be formulated on the basis of either detached education or medical needs alone. The situation in general education, and the conditions of economic and social life in this country, are not strictly comparable with those abroad. It has been felt desirable for some time that a study of medical education based on the special conditions in this country should be made. [Page 8.]

It was hoped that a study of this kind might establish certain fundamental relationships which, if accepted, would allow the universi-

ties greater freedom in their endeavor to modify the rigid, overcrowded, and overstandardized curriculum, and to conduct medical training along more sound educational lines. Several of the universities have already initiated important changes in medical teaching and others are planning to do so. [Page 9.]

CHAPTER I. OBJECTIVE OF [THE] STUDY

Medical education concerns itself primarily with the qualifications and preparation of students to practise medicine. The basic course [curriculum] should be devoted to the principles of the sciences which are necessary for an understanding of health and disease; to the application of those principles which are helpful in diagnosis and treatment, and in controlling or preventing illness; and to the development of a sympathetic appreciation of the human, economic, and social features which in many instances are the determining factors in medical practice. The basic course [curriculum] should be focused upon an effort to train students so they may be competent to begin the practice of medicine, and to supply a foundation for the continuing self-education so essential for the physician, if he is to function most effectively throughout his professional life. The training should be sufficiently broad and sound to serve as the groundwork for subsequent preparation for those who desire to go into one of the specialties of medical practice, into research in one of the sciences or in some branch of clinical medicine, into public health work, into medical teaching, or into some field allied to medicine. This conception of the basic course [curriculum] presupposes an understanding on the part of medical educators of the problems of medical practice. It is true that many of the requirements of the medical curriculum and of medical licensure have been worked out by individuals familiar with these problems, but some of the features that are now modifying medical practice have not been reflected in medical teaching. [Page 11.]

The medical profession, broadly speaking, has a responsibility not only for the adequate preparation of individuals to begin the practice of medicine, but in a larger sense to keep the entire profession familiarized with and competent to use the best methods of diagnosis, treatment, and prevention of disease. [Page 11.]

The medical profession is interested in and should exert what influence it can to secure a more satisfactory distribution of physicians, to the end that the large expenditures of time, energy, and money by individuals and universities shall not be wasted through chance distribution of medical graduates. [Page 12.]

The enormous growth of knowledge of disease, and of methods of control and prevention; the inevitable division of labor and the development of specialization; the increasing emphasis on early diagnosis and treatment; the expansion of hospitals, dispensaries, organized home nursing, social service and industrial medical services; the increasing employment of health officers with nurses, laboratory technicians, inspectors, and other personnel, are a few of the factors which are influencing the character of medical practice. The trend of the population toward urban centers with their highly organized industrial and community life, the growth of rapid communication and transportation which has greatly extended the practice-radius of physicians and increased the zones of competition, need only be mentioned to suggest a train of other factors. The control of many communicable diseases through public health efforts is another large influence. Better conditions of living and working, more out-door activities and recreation, *better care of the teeth*,[2] eyes and throat, the decline of child labor, the more rational feeding of babies and children, the control of milk and water supplies and of sewage disposal, vaccination, and the more intelligent use of surgeons and physicans, have a definite influence on the frequency and character of illness and, in a corresponding degree, on medical practice. While changes in community life are modifying the character of medical practice, the great growth of knowledge of the causes, treatment, and methods of preventing illness has had, at the same time, marked and far-reaching effects on individual and community welfare. [Page 12.]

CHAPTER II. DEMANDS FOR MEDICAL SERVICE

Most of the physicans report little or no health advisory work on presumably well individuals; their advisory functions are almost

[2] [Italic not in the original. See also pages 48, 49, 50, 51, and 52, for additional significant references to the relation of dentistry to health service in general.]

exclusively in connection with the treatment of actual illness. While there is some increase in this type of work, it is largely undeveloped, although it probably represents one of the largest opportunities for the general practitioner.[3] [Pages 15 and 16.]

The majority of illnesses seen by practitioners are not difficult of diagnosis and most of them require rather simple treatment. [Page 16.]

Over 90 per cent of the demands are for illnesses which can not be controlled on a community basis, but are the problems of individual patients. This strongly emphasizes the necessity of studying and treating the individual as well as the illness. The fact that such a large proportion of the medical demands are individual problems is only a recognition of the enormous contribution which public health efforts have made in the control of such diseases as diphtheria, typhoid fever, small pox, yellow fever, malaria, hookworm, and septic sore throat. . . . . The control of water and milk supply, food inspection, and the constant vigilance of the health authorities have been a few of the factors which have brought about a reduction in these and other diseases. The increasing efficiency of community health work is changing the character of medical practice to a higher proportion of individual health problems.[4] [Page 18.]

[3] [See the related quotation on pages 68 and 69; also footnote 20 on page 69. In a reference to the more advanced conditions in dental practice, the Carnegie Foundation's *Bulletin on Dental Education in the United States and Canada* (1926) presents the following comment (page 236): "For many years dentists have systematically encouraged their patients to submit to periodic precautionary examinations for the diagnosis and treatment of dental disorders in their incipiency, and for the application of direct measures of oral hygiene. The importance of this procedure for children, in whom most dental abnormalities and diseases may be arrested, cured, or corrected, cannot be overestimated. These efforts by the dental practitioner, to discover promptly the incidence of oral maladies and to prevent their extension in his patients individually, exemplifies an ideal of health service—to keep people well—which has not yet appealed strongly to the average practitioner of medicine, who, manifesting little concern about prevention of illness among his private patients, seldom gives them personal advisory health-service when they are not sick. This notable difference between the direct efforts of dentists and physicians, in which dentists have set a useful example by endeavoring to convert a passive aspect of health service into an active phase, suggests an opportunity for marked improvement of medical practice in harmony with the popular expectations that are being developed by progressive public education for the conservation of health, in which lay agencies and medicine, dentistry, and nursing are actively participating.]

[4] [Distinctions between health service in general, and the practice of conventional medicine in particular, are included in this comment and at other places in the Report.]

In every medical problem there are human and psychological factors, an understanding of which is frequently essential for proper diagnosis and treatment of the patient. [Page 20.]

In the larger cities probably 20–25 per cent of the population who seek ambulatory medical attention receive a part or all of it in the organized clinics and out-patient services. [Page 21.]

CHAPTER III. NEEDS FOR MEDICAL SERVICE

Physical inspection of school children has shown a large number with physical impairments, many of which remain permanent or con-

TABLE XIX [Page 76]

*Defects or diseases found in 17,154 school children in Missouri based on a survey by the United States Public Health Service**

DEFECTS OR DISEASES	PERCENT
Decayed teeth [Italic not in the original]	53.6
Enlarged tonsils	38.2
Mouth breathing	23.6
Defective vision	15.9
Adenoids	11.2
Diseased tonsils	4.5
Defective hearing	4.4
Conjunctivitis	3.5
Heart affections	3.0
Orthopedic diseases	1.5
Tuberculosis	0.4

* Progress report in field investigations in child hygiene in the State of Missouri to June 30, 1920: C. P. Knight (Public Health Report, Vol. XXV, no. 53).

tribute to disabilities later in life. A single analysis, shown in *Table XIX*, illustrates the types of defect found among school children in the State of Missouri, as reported by the United States Public Health Service. [Page 23.]

The Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association submitted estimates in 1918 on the physical and mental conditions of school children in the United States, which are given in an abbreviated form in *Table XX*. [Page 23.]

TABLE XX [Page 76]

*Estimate of physical and mental conditions of 22,000,000 school children in the United States, 1918**

At least 1 per cent—200,000 children—are mentally defective.

Over 1 per cent—250,000—are handicapped by organic heart disease.

At least 5 per cent—1,000,000—have now, or have had, tuberculosis.

5 per cent—1,000,000—have defective hearing, which unrecognized gives many the undeserved reputation of being mentally defective.

25 per cent—5,000,000—have defective eyes. All but a small percentage of these can be corrected.

15–25 per cent—3,000,000 to 5,000,000—are suffering from malnutrition, and poverty is not the most important cause of this serious barrier to healthy development.

15–25 per cent—3,000,000 to 5,000,000—have adenoids, diseased tonsils, or other glandular defects.

10–20 per cent—2,000,000 to 4,000,000—have weak foot arches, weak spines, or other joint defects.

50–75 per cent—11,000,000 to 16,000,000—have defective teeth and all defective teeth are more or less injurious to health. [Italic not in the original.]

75 per cent—16,000,000—have physical defects which are potentially or actually detrimental to health. Most of these defects are remediable.

* Estimate submitted by the Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association.

TABLE XXI [Page 77]

*Estimate of the percentage of physically defective likely to be found in any community, made by the Committee on Health Problems of the National Council of Education**

DEFECTS AND DISEASES	PERCENTAGES WITH EACH SPECIFIED DEFECT	
	Urban	Rural
Teeth [Italic not in the original]	33.5	49.0
Tonsils	16.4	28.1
Adenoids	12.5	23.4
Eye	13.4	21.0
Ear	1.3	4.7
Malnutrition	7.6	16.0
Enlarged glands	2.7	6.4
Breathing	2.1	4.2
Spinal curvature	0.8	3.5
Anemia	1.5	1.6
Lungs	0.3	1.2
Heart	0.4	0.8
Mental	0.2	0.8

* Report of Illinois Health Insurance Commission of the State of Illinois, May 1, 1919.

TABLE XXII [Page 77]

*Analysis of typical industrial groups**

(Figures derived from more than 10,000 cases; males—average age 34)

	PERCENT
Class 1. No physical defect or impairment reported. No modification of living habits required	0
Class 2. Slight physical impairment or defect requiring some form of hygienic guidance	10
Class 3. Moderate physical impairment or defect requiring some form of hygienic guidance or minor medical, *dental*, or surgical treatment. [Italic not in the original.]	41
Class 4. Moderate physical impairment or defect, medical supervision or treatment advised in addition to hygienic guidance	35
Class 5. Advanced physical impairment or defect requiring systematic medical supervision or treatment	9
Class 6. Serious physical impairment or defect urgently demanding immediate attention	5

* "Health Building and Life Extension," Eugene Lyman Fisk, M.D.

TABLE XXIII [Page 78]

*Specified errors in hygiene and minor complaints among 16,662 male policy holders, as reported in a study by the Metropolitan Life Insurance Company**

PERSONAL HABITS AND CONDITIONS	PERCENT
Too high protein diet	37.6
Too little water consumed	36.9
Too much tea and coffee	40.7
Other errors in diet	46.6
Tobacco, excessive	33.1
Hours of work too long	26.4
Lack of exercise	60.8
Overweight (20 per cent or greater)	12.9
Defective vision, corrected	25.4
Defective vision, uncorrected	29.5
Enlarged, septic, or buried tonsils	26.2
Heavy dentistry—x-ray advised. [Italic not in the original.]	41.8
Constipation	39.7
Hemorrhoids	12.3
Frequent or severe headaches	15.4
Frequent colds	17.7

* Physical defects as revealed by periodic health examinations: Louis I. Dublin, Eugene Lyman Fisk, and Edwin W. Kopf; *American Journal of the Medical Sciences*, 1925, clxx; October.

Estimates have been made of the frequency of physical defects of various kinds among the rural and urban population, and the report of the Committee on Health Problems of the National Council of Education shows a higher proportion among school children in the rural districts than in the cities (*Table XXI*). [Pages 23 and 24.]

The results of the examinations of about 10,000 male industrial employees by the Life Extension Institute is shown in *Table XXII*. The frequency of poor personal habits and of minor defects is reported in an interesting study made among 16,662 male policy holders of the Metropolitan Life Insurance Company, as shown in part in *Table XXIII*. [Page 24.]

Dental defects. Routine physical examinations of adults reveal a large number of defects of the mouth and teeth not ordinarily recorded. Many of these are much more important factors in general health than is usually recognized. Their influence in respiration, mastication of food, predisposition to infections and tooth decay, and similar questions, have received serious attention only of late. Most of these difficulties can be corrected in childhood, and the active attention now given to dental and mouth conditions in children is an important feature of health work. The frequency with which some of these conditions occur is illustrated in a series of x-ray examinations at the head office of the Life Extension Institute in connection with periodic health examinations of 4,100 individuals:[5]

	Per cent
Root infection	58
Root canals filled (pulpless teeth)	59
Alveolar resorption (pyorrhea)	84
Impacted molars	4

In the sickness survey of Framingham,[6] defective teeth were recorded in the routine examination of about 32 per cent of the 4,473 individuals examined. The Joint Committee on Health Problems in Education of the National Education Association and the American Medical Association estimated that 50–75 per cent of school children have defective teeth. [Page 24.]

[5] Framingham Monograph No. 4, Medical Series II, National Tuberculosis Association.
[6] "Health Building and Life Extension," Eugene Lyman Fisk, M.D.

Dental and mouth defects are common and are important factors in health. Most of them can be corrected in childhood, and the efforts of the dental profession and school authorities to remedy them in early life is an important contribution to health work.[7] [Page 25.]

CHAPTER IV. DISTRIBUTION OF PHYSICIANS, AND SPECIALIZATION

The population per physician has increased considerably in the smaller communities and there has been a moderate increase for the entire country, even for the large cities. This last point is often overlooked. The population per physician [1906 compared with 1923] in towns of 1,000 to 2,500 has increased 54 per cent, whereas in cities of 50,000 to 100,000 the increase has been only 5 per cent, and in cities of over 100,000 the increase has been 9 percent. [Page 26.]

The distribution of physicians is governed by a number of factors. There can be little doubt, however, that the question is closely identified with the relatively unfavorable economic, educational, and social condition in the agricultural districts of the country, which is one of the most pressing national problems at the present time. [Page 26.]

The greater opportunity in the cities for earning financial and other rewards for professional efforts is the outstanding cause of the tendency of physicians to locate in the cities. There may be some merit, however, to the opinion that other factors are also operative. These include changes in the character of medical practice and the better facilities in the cities to conduct practice according to the most approved methods. The absence of adequate hospital and other facilities in many of the smaller communities probably plays a part Furthermore, some features of medical training, especially the inevitable emphasis in the hospitals and during the interneship on the major and most serious illnesses and the dependence on specialists, well organized hospital, nursing, laboratory, and consultant services,

[7] [The comment under the head of "dental defects" encourages the expectation that medical schools will soon give to oral health service the degree of attention it merits in the training of general practitioners of medicine. "The unconcern for clinical dentistry at medical schools" is discussed on pages 246 and 247 of the Carnegie Foundation's *Bulletin on Dental Education in the United States and Canada* (1926).]

tend to make a recent graduate hesitate to assume the responsibility of individual practice in a small community. [Page 27.]

Various reasons have been assigned by different students of the problem to explain the irregular distribution of physicians. Included in the reasons which refer particularly to medical education are the reduction in the number of medical schools; reduction in the number of the student body and hence of medical graduates; the elevation of standards of medical education with the lengthening of the course [curriculum]—particularly in the pre-medical requirements; the increasing cost to the individual of securing a medical training, not only in direct expenses but in loss of time during his productive period; the tendency of medical schools to disregard the preparation of physicians for general practice and the over-emphasis upon research and medical specialties. Others have ascribed the chief causes to economic and social conditions in the rural communities, in many of which a physician would have great difficulty in making a competent living, and in which the social life, educational facilities, and professional contacts are less attractive than in the cities. The automobile, good roads, and the telephone have made it possible for city physicians to enter directly into competition with practitioners in the smaller communities, particularly in relation to patients who are able to go to the cities for medical or hospital care, or to pay for the services of a physician from a nearby city. Furthermore, many physicians trained under present methods in hospitals and clinics are not desirous of practising where these facilities, which have come to be regarded as necessary for proper practice, are not available. [Pages 29 and 30.]

Several suggestions have been made that the distribution of physicians in the smaller and rural communities could be helped by shortening the period of medical training. The proponents of this suggestion maintain that because the cost of medical education is so high, recent medical graduates go to the cities where there is more certain and easier return on their investment of time and money. It is claimed by some that graduates of a medical course which would be cheaper and shorter than that now in force would be less likely to locate in the cities. A study of the distribution of over 2,000 graduates of one of the largest schools of chiropractic, which gives a course considerably shorter than that of medicine, reveals that 90.2 per cent

of the graduates located in communities of 50,000 or more. This is a much higher proportion than that of recent medical graduates as reported elsewhere in this chapter. Dr. W. A. Pusey, however, has made a study, as yet unpublished, of the non-medical practitioners in 162 of the 283 rural counties in which the age distribution of physicians was reported by him. He found that 431 non-medical practitioners had located in these counties in the last ten years, compared with only 197 physicians; 121 had located in 64 of the 100 counties in which no physician had located within the last ten years. [Page 30.]

There can be little doubt that the man who is to practice medicine in a small community should be at least as well trained as his city colleague. Some maintain that he should have an even better preparation to meet, as he must single-handed, many of the conditions which confront him in the smaller communities, often at a distance from consulting services, hospitals, laboratories, and other facilities. A somewhat different emphasis, however, is made by others who believe that the present long preparation for medical practice contains a considerable amount of unimportant detail which could be dispensed with, thereby shortening the time of preparation at the expense of irrelevant and unnecessary subject matter.[5] [Page 30.]

Another point of importance is that there is no organized attempt on the part of the universities to influence the distribution of medical graduates. Individual universities are doing what they can to satisfy

[5] [Recently, in a published address to the students in a university medical school, a member of the Commission on Medical Education, who is also a member of the Council on Medical Education of the American Medical Association, referring to present deficiencies, said that "in a certain school the coagulation of the blood was taught thirteen different times to a single class of students, with some little difference each time. . . . . If we could have not more time for the curriculum, but a more complete and intelligent use of the student's time without too much needless repetition, we could go much further in our undergraduate curriculum. . . . . We have had [are having?] a hard time in the medical course [curriculum] in getting rid of the operators and of the specialists who want to stress the refinements of their specialties. There is enough to learn without this in the ordinary routine work of medicine and surgery in the undergraduate course [curriculum]. . . . . Success in medical practice does not depend on how much you know. Success depends on how much you can apply to the particular person who comes to you seeking relief. . . . . Medicine is throwing off outworn facts, and ten years from today you can no longer depend on what you consider complete at the present time."]

TABLE XXIX [Page 81]

*Analysis of specialization in medical practice in the United States, 1925**

	NUMBER OF PHYSICIANS LIMITING PRACTICE TO SPECIALTY	
Head specialties		4,737
Ophthalmology, otology, laryngology, rhinology	3,106	
Ophthalmology	814	
Otology, laryngology, rhinology	783	
Laryngology, rhinology	34	
General surgery		3,220
Internal medicine		1,958
Neurology and psychiatry		945
Neurology and psychiatry, combined	589	
Psychiatry	233	
Neurology	123	
Urology		762
Obstetrics and gynecology		696
Obstetrics and gynecology, combined	351	
Gynecology	197	
Obstetrics	148	
Pediatrics		664
Roentgenology		588
Dermatology		361
Orthopedic surgery		326
Pathology and bacteriology		317
Clinical pathology	158	
Pathology	131	
Bacteriology	28	
Public health		315
Tuberculosis		305
Proctology		116
Anesthesia		107
Total		15,417

* Council on Medical Education and Hospitals, American Medical Association.

inquiries from students for openings, or from communities for physicians. The distribution of physicians is largely dependent upon chance personal contacts of the medical student, a lack of method which is highly uneconomic and inefficient. [Page 31.]

Another phase of the question of the distribution of physicians is the relative number of specialists. *Table XXIX* shows the total number of physicians in the United States who limit their practice to a specialty.[9] This group represents approximately 10.5 per cent of all physicians in the country. There has been an increase in the tendency of recent graduates to specialize. In Indiana, 16 per cent of the graduates of 5–15 years, and only 10 per cent of the graduates of 15 or more years, limit their practice to a specialty. In Louisiana, these figures are 19 per cent vs. 11 per cent; in Wisconsin, 15 per cent vs. 13 per cent; in Connecticut, 18 per cent vs. 18 per cent. It is

TABLE XXXII [Page 83]

*Medical college graduates who have limited their practice to a specialty, according to years of general practice, classes of 1915 and 1920**

YEARS OF GENERAL PRACTICE	GRADUATES—CLASS OF 1915	GRADUATES—CLASS OF 1920
	percent	*percent*
No previous general practice	33.4	53.7
Less than two years	5.8	14.0
Two to four years	22.9	26.0
Five to nine years	31.9	4.0
Over nine years	3.8	
Not reported	2.2	2.4

* "Extent of Specialization in Medical Practice," H. G. Weiskotten, M.D.

well established that the percentage of specialists in the larger cities is much higher than in smaller communities. In such typical states as Wisconsin, Indiana, and Louisiana, 20–25 per cent of all practitioners in communities of 50,000 or more restrict themselves to a specialty, whereas in communities of 10,000 or less the proportion is about 3 per cent and in communities of 5,000 or less, about 2 per cent. [Page 32.]

Dean Weiskotten has made a study of the graduates of the classes of 1915 and 1920 of fifty-two medical schools, 66 per cent of whom

[9] [In 1925, this number was 15,417. Compare it with the 65,000 practitioners of dentistry, and reflect on the serious difficulties in the way of training *general* practitioners of dentistry as "head specialists" ("stomatologists") of *conventional* medicine. See also *Table XXXII* on this page.]

answered his inquiry regarding specialization. . . . . It was found that 33.4 per cent of the 1915 class and 53.7 per cent of the 1920 class restricted their practice without a preliminary period of general practice (*Table XXXII*). [Pages 32 and 33.]

The average age of physicians in the United States has risen sharply. In the small communities and rural districts the average age is about fifty-two years. At the present time there are, however, practically no communities of 1,000 or more population without a resident physician, and there are over 20,000 communities of less than 1,000 which still have a physician. The present situation in itself is not alarming, but many communities will shortly be without a resident physician, if the current trend of graduates to locate in the cities continues. In many instances, however, this does not mean a loss of medical service for the given community. The automobile, good roads, and the telephone, by greatly extending the radius of medical practice, can largely compensate for the loss of a resident physician. This applies, however, only to those able or willing to pay for the extra costs of securing medical service from a distance, and in those sections of the country where roads are passable throughout the year. [Page 33.]

The distribution of medical practitioners, while very important, must be secondary to the determination of what constitutes a sound, adequate, preparation for medical practice. Any attempt to secure distribution at the expense of proper preparation will eventually fail to meet the situation satisfactorily. [Page 34.]

CHAPTER V. SUPPLY OF PHYSICIANS

The future population of the United States can be estimated by several methods, but perhaps the best is that used by Raymond Pearl. On the basis of that method the population for the United States is estimated as follows [page 39]:

1925	115,000,000
1935	129,000,000
1945	142,000,000
1955	154,000,000
1965	164,000,000

In 1965 the estimated population will be 164,000,000 and at that time the end of the period of prediction of the number of physicians, on the basis of several assumptions, will have been reached. For the intervening period the population per practising physician under 65 years of age for the several decades is estimated as follows [page 40]:

NUMBER GRADUATING EACH YEAR	AGE AT BEGINNING OF PRACTICE	1925	1935	1945	1955	1965
4,000	28	891	1,057	1,246	1,305	1,262
4,400		891	1,040	1,174	1,203	1,147
4,800		891	1,016	1,118	1,116	1,051
4,000	27	891	1,032	1,203	1,262	1,233
4,400		891	1,000	1,136	1,167	1,116
4,800		891	977	1,076	1,077	1,025
4,000	26	891	1,000	1,164	1,232	1,197
4,400		891	969	1,101	1,132	1,093
4,800		891	949	1,044	1,048	1,000

The average age of physicians is rising. Many have felt that the present trend in this regard is abnormal, but the results of the study of the life-tables made for us in connection with the present discussion do not confirm this belief, as shown below [page 40]:

AGES	ALL MALE[10] PHYSICIANS 1900	WHITE MALE[10] PHYSICIANS 1925	ALL PHYSICIANS (1962) (ON BASIS OF GRADUATES BEGINNING PRACTICE AT 28 YEARS OF AGE)
	percent	*percent*	*percent*
Under thirty-four	34.8	15.1	17.3
Thirty-five to forty-four	26.2	23.5	23.7
Forty-five to fifty-four	18.7	30.9	21.9
Fifty-five to sixty-four	11.8	18.4	18.5
Sixty-five and over	8.2	12.1	18.6
Unknown	0.3		

The above studies point to the importance of securing as early graduation from medical schools as is consistent with necessary maturity and previous education. There is a growing opinion that the

[10] From "Death Rates of Male White Physicians in the United States, by Age and Cause," Emerson and Hughes.

period of elementary and secondary school education can be advantageously shortened by several years. Studies of this possibility have been made by the educational bodies concerned with this phase of education. It is quite possible that the lengthening of professional training (including the college period) could be compensated for in part by a shortening of earlier training. The period in college and in the medical school could also be modified by the elimination of the long vacations, and possibly by a certain amount of reorganization of the course [curriculum].[11] A part of the time thus saved could be profitably employed in additional clinical training for the 95 per cent of the students who intend to practise medicine in some capacity. The data brought out by our study of the probable future numbers and age-distribution of the medical profession add weight to the arguments from many other sources which point to the importance and advantage of shortening the period of elementary and secondary school education.[12] [Page 41.]

CHAPTER VI. RECRUITMENT OF STUDENTS

At present the requirements for admission to a medical school of recognized standard are graduation from an accredited high school, or its equivalent, and a minimum of sixty semester hours of college work, including [page 44]:

Chemistry	12 semester hours
Physics	8 semester hours
Biology	8 semester hours
English literature and composition	6 semester hours

These are only the minimum requirements; an increasing proportion of students have more preparation than this. *Table XXXIX* shows the increase of medical graduates with liberal arts degrees, an increase from 15.3 per cent in 1910 to 61.2 per cent in 1925. A study of the third-year classes of twelve of the well known medical schools reveals

[11] [See the synopsis of the two-three-graduate plan: *Journal of Dental Research*, 1927, vii, p. 441.]

[12] [The same data also suggest "the importance and advantage of shortening the period" of professional education for *general* practitioners. See also footnotes 8 and 15, on pages 54 and 62-63, respectively.]

that from 50 per cent to 100 per cent of the students have a previous university degree. Preference is naturally given to applicants with the highest qualifications, and those with university degrees usually receive first consideration. For the average student, a university degree is practically the requirement for admission to a number of medical schools. [Page 44.]

As mentioned earlier, the number of medical students has fluctuated considerably during the last twenty to twenty-five years. From a high enrollment of over 28,000 in 1904 there was a drop to under 13,000 in 1919, and a recovery to 18,840 in 1926. During this same period

TABLE XXXIX [Page 88]

*Medical graduates with liberal arts degrees**

YEAR	PERCENT
1910	15.3
1915	24.3
1920	43.5
1921	46.0
1922	57.5
1923	57.3
1924	56.7
1925	61.2
1926	60.3

* *Journal of the American Medical Association*, 1926, lxxxvii (August 21). [Most of the "liberal arts degrees" were received, on the current plan of combined academic and medical curricula, after two or three years of approved work in an accredited medical school. The figures do not indicate the number who received bachelor degrees before admission to the medical school.]

there has been a large increase in students in the primary and secondary schools, and in the colleges. A study by the Bureau of Education,[13] for example, shows the following comparisons between 1890 and 1922 [page 45]:

	Per cent
Increase in population	73.5
Increase in high school enrollment	610
Increase in college enrollment	346

[13] "Statistical Survey of Education, 1921–22," Frank M. Phillips, Department of the Interior, Bureau of Education; *Bulletin*, 1924, No. 38.

Other studies of college enrollment have indicated a 700 per cent increase between 1900 and 1925. The increase in these student bodies has been reflected in an increase in most of the professions, although there has been an actual decrease in medicine [0.7 per cent between 1910 and 1920]. The decrease in medicine is explained by the fact that during the period previous to 1910 there was a considerable overproduction of physicians. The following table gives the percentages of increase in several professions between the years 1910 and 1920 [page 45]:[14]

	Increase Per cent
Population	15
Architects	9
Chemists	102
Clergymen	8
College presidents and professors	113
Dentists	40
Lawyers, judges and justices	7
Teachers	27
Technical engineers	65
Trained nurses	81
Healers (except osteopaths and physicians)	116
Religious, charity, and welfare workers	157

CHAPTER VII. CRITICISMS BY PRACTITIONERS OF THEIR MEDICAL TRAINING

To the inquiry, "Do you consider your preparation in medical school adequate?," the ..... grouping of answers [on the succeeding page] was obtained [page 47]:

[14] Fourteenth Census of the United States, Population 1920, Volume IV; Bureau of the Census.

Percentage who considered training adequate	*Disease groups*
80–90	Respiratory infections Obstetrics Minor medical complaints Minor surgery Gastro-intestinal diseases Children's diseases General medical diseases
70–80	Infant feeding Contagious diseases Surgical emergencies
Below 70	Functional nervous disorders Nutritional disorders Eye and ear diseases Orthopedic diseases

It is quite evident that the groups of diseases with which these graduates felt least well prepared to deal were largely those of orthopedics; functional, nervous, and nutritional disorders; and diseases of the eye and ear. The practitioner evidently feels least well trained in the group of disorders so prominent in the practice of the various cults, probably in part because of competition from these practitioners. Less than 60 per cent of the practitioners whom we questioned felt that their training was sufficient in dealing with medico-legal, workmen's compensation, and similar problems. [Page 47.]

We also asked for general comments from these men relative to their preparation in the light of subsequent experience in medical practice. *The outstanding criticisms relative to the fundamental sciences concerned the large amount of time spent in laboratory work and the methods of instruction. In the opinion of many of the group, there was a lack of correlation in the presentation of the fundamental sciences. Some felt that there should be a closer correlation also with the clinical problems.*[15]

[15] [In a recent review of Cushing's "Life of Sir William Osler," one of the Harvard members of the Commission on Medical Education (who has also held professorships at the University of California and Columbia University) wrote in part as follows: " . . . . While educational system cannot bestow unusual qualities, it may easily facilitate their blossoming or frost them in the ground. . . . . If one makes an impertinent habit of inquiring, one . . . . is astonished to discover how large a percentage of the most

[Italic not in the original.] In regard to the clinical training, they stated that too much time was spent in the demonstration and study of unusual diseases which were only rarely seen in practice, and insufficient time in such subjects as therapeutics. They believed that more time should be spent in the study and treatment of the common complaints, such as contagious diseases and minor surgery, and in the problems of infant feeding. Along with this general type of comment were references to the fact that most of the teaching is done by specialists, with an overemphasis on problems of research and on diseases seen largely by the specialist;[16] to the overcrowding of the curriculum, with little time for reading or other activities; and to the emphasis on theory at the expense of practical work. [Page 48.]

The second comment, which appeared in a great many of the replies, referred to the feeling of incompetence on the part of the recent graduate to deal with the patient and the family. Some of the criticisms were directed against the methods of teaching in the hospital period, when the interne sees patients cared for almost entirely by specialists; when extensive laboratory and other studies are made upon a large number of the patients; when the chief reliance for diagnosis is placed upon x-rays and laboratory procedures; when mostly serious and unusual illnesses are seen—all of which tends to give the student an erroneous impression of medical practice and to make him hesitant

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distinguished, successful, and superbly skilful physicians, surgeons and practising specialists have little memory, no comprehension and almost no need for the fundamental principles of science which they once studied, and which are indispensable to the laboratory and clinical investigative branches. When they do use the results of laboratory progress, as they are constantly doing, they use them more or less as the average man uses a watch—without knowing exactly how it works. There may be some way by which this type of medical man may be given enough of the fundamental training which he needs to comprehend progress without dwarfing his education in other directions. It must be accomplished without lowering the standards or opportunities for intensive scientific training offered to the others, and the minimum required of all medical men must be sufficiently comprehensive to give the future clinician the mental equipment by which he can keep abreast of technical advances. Eventually it may be necessary to surrender to the inevitable and admit that preparation for medical training necessitates a specialization in the pure sciences so intense that only the exceptional individual can find time or opportunity for development in other directions. For the present, however, a sensible compromise is possible, and we cannot afford to lose the Osler type in medical life." *New Republic*, 1925, xlv, p. 61; December 2.]

[16] [See footnote 8, on page 54.]

to begin practice outside of large medical centers.[17] Evidently this period of training has certain disadvantages in fitting a student to enter medical practice in communities where these facilities and personnel—specialists, hospitals, laboratories, technicians, nurses, social service departments, physiotherapists—are not available. [Page 48.]

Associated with this comment is that of a considerable number of the men who felt at a disadvantage in handling patients from the psychological point of view. They remark that in the medical school and hospital there is an impersonal attitude toward most of the patients, probably in part the result of the division of responsibility for the care of patients in an organization.[17] When the graduate goes into practice, however, the situation is entirely different, as he is called upon to take personal responsibility in diagnosis and in advising treatment, consultation, hospitalization, or other procedures. [Pages 48 and 49.]

CHAPTER VIII. COMMUNITY PROVISIONS FOR MEDICAL SERVICE

There is a lack of adequate hospital, laboratory and nursing facilities, and of consultant services—particularly in pediatrics and psychiatry—in a considerable number of the smaller communities. These features have come to be regarded as necessary for proper medical practice and have been emphasized in medical training. Their lack in some communities is probably a factor in the uneven distribution of practitioners. [Page 51.]

The practitioners in our study estimated that less than 10 per cent of their patients needed hospital care and that they felt competent to diagnose and treat over 90 per cent of the complaints met in their practice without the aid of consultants or specialists. [Page 51.]

CHAPTER IX. INFLUENCE OF MEDICAL LICENSURE

The requirements of the different states for medical licensure can be divided roughly into two groups: regulations made by the respec-

[17] [The important difference between these conditions, and those in the clinical instruction of dental students in the dental infirmary, has been emphasized in the Carnegie Foundation's *Bulletin on Dental Education in the United States and Canada* (1926), pp. 138 and 236.]

tive boards of medical examiners, and specific statutes. The regulations can be modified by each board, and for the most part present no difficulties to the recent graduates of good medical schools (*Table XLIII*). There is closer general agreement in the requirements of these boards than is ordinarily assumed. A certain number of the states, however, have embodied their requirements into statutes which cannot be changed except by legislative action. These statutory requirements fall under five general headings as follows (the number of states specifying each is given):

1. Four courses of instruction in separate calendar years—11 states.

2. Forty months to elapse between the beginning and end of the course—2 states.

TABLE XLIII [Page 90]

*Results of state licensing board examinations for 1925, and several previous years**

YEAR	ALL CANDIDATES EXAMINED		RECENT GRADUATES	OLDER GRADUATES	NONDESCRIPT	TOTAL REGISTERED
	Examined	Percentage failed	Percentage failed	Percentage failed	Percentage failed	
1905	7,170	20.8	16.2	37.7	61.9	6,074
1910	7,004	18.4	14.9	29.1	45.6	7,352
1915	5,313	15.6	13.2	29.3	49.2	5,872
1920	4,787	15.3	11.5	33.2	50.8	6,557
1925	5,956	9.3	5.0	29.2	53.2	7,194

* *Journal of the American Medical Association*, 1926, lxxxvi (May 15).

3. No member of the board may be a teacher in or have connection with a medical school—16 states.

4. Statement that preliminary education must be "two years of college work in a standard college or university"—5 states.

5. Medical study given in detail—2 states. [Page 52.]

Most of the regulations of the different states are made up of restrictions defining who may practise medicine, together with exemptions or other provisions which permit the practice of the various cults and irregular practitioners. Mention need only be made of the fact that between 1910 and 1920 there was an increase of 116 per cent in the number of healers of various kinds other than medical practitioners and osteopaths. In all probability the numbers have continued to rise since 1920. Some of the benefit derived from the

elevation of the standards of medical practice have been offset, as mentioned earlier, by the growth of public and legal recognition of various other forms of practice of the healing art. Multiple standards for licensure of practitioners prevent the state from rendering the fullest protection to the public, which it ostensibly undertakes when it establishes regulatory statutes. Probably the most vital feature of the treatment of illness, even in its mild forms, is that of proper diagnosis, and those who obtain permission to practice the healing art under a limited license should be as fully qualified to make proper diagnosis as those who practice under an unlimited license. The object of the state to provide practitioners who are competent to deal with the problems of illness is defeated to some extent by multiple standards and multiple boards. [Page 53.]

The recognition is growing that all individuals attempting to practise the healing art should have a similar foundation of preliminary education and should have the same reasonable knowledge and skill. In response to this attitude, states such as Connecticut, where the situation has been particularly bad, have established a single preliminary basic examination for all individuals applying for licensure to practice. Wisconsin has established the basic science law requiring all who apply for licensure to first pass examinations in the fundamental sciences, and to present credentials of adequate preparation, before being permitted to appear for examination before the respective licensing boards. A number of states are now contemplating similar requirements. When the states recognize that all practitioners of the healing art should have a fundamental scientific training, public education along the lines of sound medical practice designed to safeguard the health of the community will receive a great impetus. [Page 53.]

The possibility of a dual system of licensure to distinguish between the licensure of individuals for general practice and that for specialists —particularly for elective major surgery—has been discussed. The distinctions to be drawn in the subdivisions of practice are very elusive; possibly the difficulties of a differential licensure are insurmountable.[18] The qualifications of men are, of course, the basis of

[18] [The Carnegie Foundation's *Bulletin on Dental Education in the United States and Canada* (1926) refers to this matter as follows (pp. 201 and 202): "The two-three-graduate

selection for membership in a number of national societies, but these memberships have little significance in the community in which the individual may practice. In some communities membership on the local hospital staff has been regarded as a criterion of competency, but this is by no means a sound guide in every instance. The medical profession recommends that no one should specialize until after a period of general practice. This, however, is not being generally carried out among recent graduates, many of whom are going directly into a specialty. This situation points again to the importance of the medical schools keeping clearly in mind the objectives of medical preparation. [Pages 53 and 54.]

Medical licensure is a protective function of the state and probably cannot be abrogated, as some have suggested, by licensing graduates of certain medical schools without examination. Such a procedure would lead to difficulties in the present state of affairs in this country. It would necessitate the inspection and rating of the schools as well as certain discriminations which might not be desirable. On the other hand, the type of examination given for medical licensure ought to be essentially the objective for which the student is being prepared, and this points to the intimate coöperation which is necessary and has grown up between medical schools and the agencies of licensure. [Page 54.]

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plan comprehends effectual training for the practice of the dental specialties, and also contemplates the termination of present conditions under which any one who has been admitted to the general practice of dentistry may publicly announce himself to be an expert in a particular branch, irrespective of the validity of his claim. Further abuses of this privilege should be prevented. It would seem to be obvious that any person who has been licensed as a dentist should be free to practise any part of an accredited specialty of dentistry, provided he does so in the ordinary course of his general service, just as under analogous conditions a physician may legally do any act within the field of dentistry, if it is performed in a routine way for the treatment of disease, the relief of suffering, or the removal of disability, although not avowedly as dentistry. But just as a physician, without a license to practise dentistry, may not lawfully represent himself to be a dentist, so also a dentist who may justifiably regard himself as being superior to *general* practitioners in a particular aspect of the art should be obliged to demonstrate to the state's examiners the validity of such a claim before being permitted to induce the public to believe it. Adequate graduate study as provided in the two-three-graduate plan, a supplementary license, and periodic registration, would expedite the most skilful practice of the specialties, and also would fully safeguard the interests of the public and of the profession."]

CHAPTER X. ADDITIONAL PROBLEMS

Preparation for the specialties of practice, and graduate medical teaching in general, are receiving active attention from the medical schools, universities, and the profession. Reference has been made to the importance of keeping practitioners familiarized with the best methods of diagnosis and treatment, if the profession is to realize its fullest usefulness. Extension courses of several types have been developed by a number of medical schools. Some of these have been in the nature of intensive courses in certain subjects, given usually at the medical school and teaching hospital; others have been attempts to carry extension teaching to the physician to obviate the necessity of the practitioner leaving his work. The latter method has been developed by coöperation between the local medical societies, the state health departments, and the universities. Clinics and demonstrations conducted by medical teachers in local hospitals are regarded as an important form of continuation training. This program emphasizes the growing importance of the hospital in small communities as a training-teaching center as well as an agency for curative, corrective, and preventive medicine. Another type of educational work is the "clinical congress" or "assembly," which is evidently popular. More formal courses of graduate training are provided in many of the medical schools, in which a physician may spend a period of study in the laboratories and clinics, often as a step in specialization. [Page 56.]

Public education in matters of health and disease is making rapid progress, and the medical profession is taking an active part in the program. The general public are beginning to realize that, within limits, health can be conserved, and that the prevention of disease and disability is often possible. The growth of periodic medical examinations need only be cited as an illustration.[19] Physicians of the future, particularly the general practitioners, will probably be increasingly concerned with early diagnosis and treatment, with the prevention of illness and with advisory health work.[19] One of the large problems before the medical profession is to devise methods of

[19] [See pages 46 and 47 and footnotes 3 (page 47) and 20 (page 69).]

sound public education in this direction, and to work out the economic features on an equitable basis.[20] [Pages 56 and 57.]

The high frequency of mental and behavior disorders indicates a large special problem. The opportunities for medically trained executives in public health, industrial medicine, hospital and clinic administration, and similar fields only suggest other questions, largely of graduate training. The present preliminary report does not deal with these problems, but they have a close relationship to the basic course [curriculum]. [Page 57.]

[20] [Dentists, who have long been accustomed to make "periodic examinations" for the early detection and repression of dental disorders, will read with interest the following frank comment in *Clinical Medicine and Surgery* (August, 1927), which was quoted as an editorial in the *Journal of the Indiana State Medical Association* (1927, xx, p. 362):

"If physicians, all over the country, do not wake up to the possibilities and necessities of periodic physical examinations quite suddenly they will find that, when they do turn over sleepily and begin to rub their eyes, someone else will have run off with all the cake and jam. The people are beginning to *want* health surveys, and when that happens there will be no lack of those who are eager to give them 'something just as good.' And if *we* don't tell them the difference, they will believe that the commercial substitute really is just as good—to their undoing, perhaps.

"A good many people believe that a urinalysis is all that is needed to find out what is going on in their insides. Several life insurance companies are now offering that service, gratis, to their policy holders. Here in Chicago an organization has been formed which offers to make several urinalyses for its 'members' yearly—at a charge of $10 to $15 a year. This 'Bureau' is advertising its services in *Physical Culture* and similar publications, which are ready to exploit all sorts of quackery, and a good many otherwise sensible people are paying good money for their 'reports.'

"In the first place, it should be remembered that, for a urinary report to be of any value to anyone, the tests must be made by a thoroughly competent and reliable person. When specimens come in by wholesale, from people who are known merely by numbers, the temptation to make the time—(dis)—honored 'sink test' must be very strong—especially when it is purely a commercial proposition. In the second place, there are many serious and insidious maladies which may advance to an irremediable stage without showing any evidence in the urine. A *complete* examination is the only reliable health survey. The public should be promptly and thoroughly informed on those two points.

"The ideal person to make periodic health examinations is the family physician, provided he has made the not excessive effort necessary to do it properly. He knows the man's family, history, and personal peculiarities, and can evaluate his findings intelligently. If his patients are satisfied with a urinalysis (which they should *not* be), their own doctors can make it just as accurately and probably far more reliably than it will be made by any 'Institute' or 'Bureau,' and the cost will be more in proportion to the value of the services rendered.

"The alarm clock has gone off! If we don't get up and *get busy*, for heaven's sake, let's not 'bellyache' about the 'serious economic difficulties of the country doctor' when someone else walks off, unhindered, with what is properly ours!"]

Most of the medical schools afford opportunities for research and study either for those who desire to devote their lives to research and teaching, or for those who wish to work on problems incidental to their regular work. In some of the schools, research efforts are prominent and are liberally supported. An increasing number of university positions in medical schools are being filled with men interested in research. [Page 57.]

The present overcrowding of the medical curriculum, which has come partly as the result of the rapid growth of knowledge of medical problems, is being corrected in part through elective periods, the elimination of some of the teaching in clinical specialties, and the reduction in the amount of redundant laboratory work in the science courses. Too much use of "school-teaching" methods, instead of emphasis on learning, has accounted for the "spoon-feeding" and stressing of details in medical training. This situation has not been confined to medical teaching alone. Emphasis on the student as the real unit in education, and on knowledge rather than credit and courses, is growing rapidly in all branches of education. [Pages 57 and 58.]

Early in the report, the rigidity and regulation of medical education was mentioned. There has been a growing opinion that one of the important needs is that of experimentation in medical no less than in other branches of education. A number of experiments have been started in response to this attitude and the Commission, following its first meeting on October 19, 1925, suggested to the Association of American Medical Colleges and to the Federation of State Medical Boards that a truce of a limited number of years be established, during which any class A medical school which desires to do so may experiment with medical education without penalty to its graduates.[21] [Page 58.]

The medical profession has a direct interest in certain economic and social problems. The rising cost of medical care is arousing the interest of economists and others, and is receiving attention by the

[21] [A notable step in this direction, in dental education, was taken recently by the Department of Education of the State of New York in removing, from the dental curriculum, restrictions that prevented experimentation without assuring any public advantages. See the *Journal of Dental Research* 1927, vii, pp. 455 and 456.]

medical profession. The increasing cost is partly due to the rise for all commodities and services since the World War, but probably the largest element is the enormous expansion in our ideas of what constitutes adequate services, and in the subdivision of medical practice into specialties. Our present conception of medical care requires many supplementary features, especially for the obscure illnesses which require hospital, laboratory, x-ray or other studies, and for the hospital care of patients with serious illnesses. These and other factors are tending to put present-day care and treatment out of reach of many individuals and families, and indicate the necessity of adaptations of practice to meet the conditions. The public and voluntary support of hospitals and clinics of various types is meeting the situation in part, especially in the cities. [Page 58—the last, preceding the Appendix consisting of forty-three tables (pp. 59–90), some of which have been quoted.]

MEDICO-DENTAL CASE RECORDS: FIFTH REPORT[1]

A Clinico-pathological Study

BISSELL B. PALMER, JR., D.D.S., and MALCOLM W. CARR, D.D.S.
New York City

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I. Introduction

Although this case antedates the beginning of the present series of medico-dental case records, and the dental aspect was not developed until fifteen hours before the death of the patient, with the consequence that some desirable data is not available, the report is presented, nevertheless, as one of interest to the members of both the dental and medical professions.

II. Case M-1 (1)[2]: Acute Hemorrhagic Meningitis (2)

General history and physical examination

The patient, a Frenchman, married, thirty-six years of age, was admitted to the hospital[3] on November 22, 1921. His chief complaint

[1] The previous reports were published in the *Journal of Dental Research*: (1) 1926, vi, p. 283; (2) 1927, vii, p. 115; (3) *Ibid.*, p. 275; (4) *Ibid.*, p. 457.

[2] Numerals in parenthesis refer to numbered items in "Notes and comment," page 80.

[3] The Hahnemann Hospital, New York City.

(3) was severe occipital and orbital headache, causing him to roll from side to side in agony. There were no factors of importance in his family history (4). No details of childhood or early history (5) were obtainable. In 1913 he developed symptoms which simulated meningitis, but the history was vague. In 1914, at the outbreak of the World War, he immediately went into military service and continued four years with the French army. He was injured in the foot, and had an attack of influenza, but his medical history otherwise was negative during the war. Following the war he came to the United States. His occupation was that of chef (6). He drank wine moderately, but no stronger liquors; smoked cigarettes; and his habits in general were regular (7).

Eight days before admission to the hospital, his illness was begun by a semiconscious state, followed by severe occipital headache, more pronounced on the right side. He called in a physician who advised the patient that he was very tired and nervous, and should leave the city for a rest. The headaches and a pain in the back (8) persisting, the patient called in a chiropractor, who administered a vigorous treatment that seemed to relieve the back-pain and the head-pain temporarily, but both returned with increased severity the day before admission to the hospital. The patient consulted another physician, who, suspecting a meningeal inflammation, advised immediate hospitalization.

Upon arrival at the hospital, examination showed a well nourished and robust man, inclined to be overweight but not obese. He was suffering intensely from occipital headache and back-pain, interrupted by periods of unconsciousness, from which he aroused with a start. There were periods of irrationality. The pupils were small and reacted to light, but the left eye sluggishly (9). Papilledema (10) was present in both eyes, after instillation of homatropin (11)—more marked in the right eye. Photophobia (12) and nystagmus (13) were absent. Both eyes contained several small retinal hemorrhages (14). There was some weakness of the left side of the face (15), but the extremities were not affected. The tendon reflexes were diminished; the knee-jerk was absent (16). "Babinski" (17) was well marked in the left foot at first, but subsequent efforts failed; none in the right foot. The ab-

dominal reflex (18) was sluggish. "Kernig" (19) was marked, especially of the right side. The tongue was deviated slightly to the left (2). The systolic blood pressure was 155 mm.; diastolic (20), 80 mm.

Report of roentgenologist

"*November 25.* The examination of the skull and mastoid reveals no definite pathology except a slight cloudiness of the left mastoid" (21).

Report of otologist

"*November 25.* Otological examination (22) shows functioning cochleal (23) branches in both ears, as shown by tuning-fork tests. Right ear and membrane tympani show chronic catarrhal otitis (24). Left ear: external canal contains some dry blood or wax, and is congested. Left drum membrane is congested, but not bulging" (25).

Laboratory and miscellaneous data

Spinal fluid. A spinal puncture (26) was made on November 23, and 25 cc. of bloody spinal fluid removed. There was marked excess pressure (27). The fluid was bloody—1–30 (28), and uniformly so ("undoubtedly not due to rupture of a small vessel, as the content of the third tube had the same appearance as the first tube, and in none was it streaked"). Laboratory report on this specimen (29): "Fluid bloody after centrifugation (30); supernatant fluid is straw colored; polymorphonuclear cells, 75 per cent; no intracellular organisms, few gram-positive cocci. Blood-agar plates show pure culture of green colonies, morphologically resembling streptococci." (This was confirmed in a final report). On November 25, a second lumbar puncture (31) was made and another specimen of spinal fluid taken. It was "slightly straw colored, but absolutely clear of sediment; no increased pressure." Laboratory report: "Culture shows same conditions as first culture, diplococcus or short streptococcus producing green pigment." (Confirmed as streptococcus viridans in a final report). Cell count: Polymorphonuclears, 84 per cent; lymphocytes, 16 per cent. On November 29, a third specimen of spinal fluid was taken, and the laboratory report was "negative." Wassermann tests were negative in all dilutions.

Blood culture (32). On December 12, a blood culture was taken and reported negative.

Urinalysis (33). *November 21:* color, straw; appearance, cloudy; sediment, none; reaction, alkaline; specific gravity, 1.010; albumin, sugar, acetone, diacetic acid, and indican, negative; amorphous bodies, some; epithelia, few squamous cells. *November 23:* color, yellow; appearance, clear; sediment, slight; reaction, acid; specific gravity, 1.013; albumin, very faint trace; sugar, acetone, diacetic acid, and indican, negative; amorphous bodies, some; pus cells, few. *December 5:* color, yellow; appearance, clear; sediment, none; reaction, acid; specific gravity, 1.010; albumin, sugar, acetone, diacetic acid, and indican, negative; amorphous bodies, some; pus cells, none; epithelia, few squamous cells.

Summary of blood examinations: white cells (34)

Date	*W. B. C.*	*Polymorphonuclears Per cent*	*Large lymphocytes Per cent*
November 22	18,400	83	17
November 28	16,400	81	19
December 3	13,200	74	26
December 7	20,200	81	19
December 8	14,200	76	24

Sputum examination. November 26: Pneumococcus grouping, group IV (35).

Diagnosis. "Acute hemorrhagic meningitis due to streptococcus viridans."

Medical treatment

Spinal puncture and withdrawal of fluid (36).

Medication. Sedatives to relieve pain (codein, gr. $\frac{1}{4}$; phenacetin, gr. V; caffeine, gr. I). Urotropin (37), grs. V., every two hours. Castor oil. Magnesium sulphate. Ice cap to relieve head pains.

Case progress notes

November 22. Severe head pain, slightly irrational at times, and periods of unconsciousness. Temperature, 101–101.6; pulse, 98–92; respiration, 30.

November 23. Sleeping heavily most of the time, rational when awake. Temperature, 101.2–103.6; pulse, 92–118; respiration, 35.

November 24. Breathing with difficulty; at times resembling Cheyne-Stokes type (38). Temperature, 102.2–103.6; pulse, 100–128; respiration, 30.

November 25. Patient brighter; able to assist in moving himself for x-ray examination. Temperature, 102.6–102.8; pulse, 100–128; respiration, 30.

November 26. Continues bright, and mind is clear. Conjunctiva show none of the marked congestion formerly present. There is headache, and the patient is anxious to go home. Temperature, 101.2–102; pulse, 98–120; respiration, 25.

November 27, 28, 29. Steady general improvement. Temperature, 100–100.6; pulse, 88–110; respiration, 24.

November 30. Deep reflexes still subnormal; superficial reflexes about normal. Weakness of the muscles of the left side of the face almost disappeared. Temperature, 99–100.6; pulse, 94–98; respiration, 24.

December 1, 2. Improving; returned to general diet. Temperature, 98.4–100; pulse, 80-98; respiration, 20.

December 3, 4. Blood count coming down; patient shows general improvement. Temperature, 98–98.8; pulse, 80–96; respiration, 25.

December 5, 6. Improvement continues, patient sitting up in chair. Temperature, pulse, and respiration within normal limits.

December 7. Leucocyte count up again. No headache except upon exertion, then only slight pain. Patient sat up in a chair five hours. Temperature, pulse, and respiration within normal limits.

December 8, 9. Improvement continues; patient feels perfectly well. Temperature, pulse, and respiration within the limits of normal variation.

December 10. Discharged from the hospital.

The consensus of opinion was that the original condition had been caused by an endarteritis (39), and that, following the rupture of the cerebral artery, the blood clot had become endogenously infected from a primary focus. It was decided therefore to find the primary focus of infection, if possible. Thorough search eliminated all possible infective foci excepting an obviously infected cyst of the superior

maxilla, right side, and the possibility of a focus in the right ear, which was chronically inflamed. It was decided that the infected teeth and cyst should be removed as soon as the patient's condition warranted the procedure.

Oral surgical operation

On December 21, the patient presented himself at the office of one of the writers. He showed no evidence of the illness that he had been through, and was not suffering any observable functional impairment.

Examination of the mouth showed a pulpless, gold-crowned, bicuspid in the superior right maxilla. There was a sinus in the soft tissue

FIG. 1. SUPERIOR, RIGHT BICUSPID; PULPLESS AND GOLD-CROWNED

The roentgenogram shows the presence of two well defined cysts in the right superior maxilla.

over the bicuspid, and upon pressure pus could be seen discharging through it. Roentgenographic examination showed the presence of two well defined cysts in the right superior maxilla (*fig. 1*). The anterior cyst had evidently developed from an old infected area, which had not been eliminated at the time of removal, some years previously, of the superior right lateral incisor. The posterior cyst was emanating from the first bicuspid.

Three cubic centimeters of a 2 per cent procaine solution, containing epinephrin (1 to 40,000) was the anesthetic employed. The injection of the solution was accomplished without the slightest evidence of

systemic reaction, and, during the forty-five or more minutes during which the patient was in the office, no general symptoms were observable in even the slightest degree. A soft tissue buccal flap was elevated, the bicuspid tooth removed, the external plate of alveolus resected with rongeur forceps, and the cysts exposed and enucleated. The socket was lightly curetted, the areas sterilized, a small 5 per cent iodoform gauze drain inserted, and the flap edges sutured. A culture was taken of the root apices.[4]

The patient returned home, spent an uneventful evening, with only minor soreness evident following the absorption of the anesthetic, and retired at an early hour. According to the statement made by his wife, he slept well until six o'clock the following morning, when, awakening her, he complained of an agonizing pain in the head. The patient expired at seven o'clock, one hour later.

Autopsy

An autopsy was performed later the same day. Post-mortem examination was limited to the head. Near the floor of the right lateral ventricle was found an area of arterial degeneration covered by a large blood clot.

III. General Summary

The course of this case naturally opens the question as to whether or not the oral surgical procedure had a definite relation to the sudden death of the patient. The following etiological factors of various degrees of probability may be considered:

The terminating hemorrhage might have been caused by an extension of the progressive arterial degeneration that was the cause of the original hemorrhage in November.

The theory might be advanced that the patient died from shock; however, the fact that the patient suffered no pain during or after the operation, was not traumatized, spent a comfortable evening, and slept well during the night, indicate that he did not suffer from shock.

It might be considered that the cerebral hemorrhage, which the autopsy showed to be the actual cause of death, was induced by a sudden increase in blood pressure from the epinephrin in the anes-

[4] The culture having been lost, the results are not reported.

thetic used. Against this possibility, however, is the fact that such a hypertension would have reached its maximum soon after the administration of the solution. There were, however, no symptoms of such hypertension either during or after the injection. That an increase of blood pressure was not the causative factor is indicated by the fact that the hemorrhage developed during sleep, when the pressure is lowest.

Another interesting view of the situation is the possibility of a local cerebral exacerbation (40) at the area of the original lesion and blood clot. Possibly this was caused by excessive absorption of bacteria, or their toxins, after the surgical interference with what might have constituted the original primary focus—the cyst.

667 Madison Avenue

IV. Notes and Comment

Explanatory and supplementary

It is desirable to include, in this section, elementary terminology of both medicine and dentistry, for the medical notes may be of value to some of the dental profession, and the dental notes may be of interest to some of the medical profession.

(1) Case M-1. As these cases are reported, they are classified according to diseases of the various organs and systems. In this instance, the symbol M represents a category into which a miscellaneous group of affections will be classified.

(2) Acute hemorrhagic meningitis. An acute inflammation of the meninges; in this case, following an intracranial hemorrhage. This meningitis is therefore a *secondary meningitis*, and may occur in association with pneumonia (pneumococcic meningitis), or with any other demonstrable focus of infection, such as the middle ear, accessory nasal sinuses, oral and dental tissues, etc. One of the pyogenic organisms or the pneumococcus is usually the infective agent. The nature of the symptoms varies, being pronounced in some cases and almost latent in others. Headache, which is sometimes excruciating, is the most common symptom. While the patient is conscious this is the chief complaint; and even when semicomatose, he may continue to groan from pain. Delirium and periods of unconsciousness are common symptoms. Other symptoms of irritation, such as, restlessness, photophobia, and cutaneous hyperesthesia are frequently observed. The pupils are variable, although usually contracted at first, but dilated, unequal, and insensible, in the later stages. Retinal hemorrhages may occur. The

facial nerve may be involved, producing slight paralysis, or there may be damage to the fifth nerve, producing anesthesia. Fever is present, moderate in grade, rarely rising above 103°. The pulse may be increased in frequency at first, but one of the striking features is the slowness of the pulse in relation to the temperature. Cheyne-Stokes respiration may be observable. Kernig's sign (19) is always present. Lumbar puncture (26) is exceedingly valuable for diagnosis, and the fluid obtained is usually in excess and under increased pressure.

(3) Chief complaint. The chief complaint is the expression by the patient of the symptoms that cause greatest distress, immediately draw attention to the site of disease, and indicate the line of investigation to be followed.

(4) Family history. Inquiry into the family history may reveal certain hereditary tendencies, and is important in its relation to predisposition to disease.

(5) Past history. Inquiry into the past medical history is made for the purpose of ascertaining the patient's previous diseases that may have a bearing upon the present illness. In this case a past history of tuberculosis or syphilis would be of importance as to a possible infectious agent.

(6) Occupation. Inquiry as to the occupation of the patient is a routine consideration of history-taking, because certain occupational conditions or environments predispose to disease.

(7) Habits. The patient's habits and personal hygiene may be predisposing factors to disease.

(8) Pain in the back. In this case the pain in the back may be an indication of a spinal involvement of the meningitis.

(9) Pupillary reactions. (a) Reaction to light: the normal pupil, when exposed suddenly to light stimuli, responds by a reflex contraction of the iris. A sluggish reaction to light, or total abolition of the light reflex, signifies optic atrophy, partial or complete paralysis of the third cranial nerve, or degenerative changes in the ciliary ganglion. (b) Reaction to accommodation: when the range of vision is suddenly transferred from a distant objective point to an object near at hand, the pupils contract and the eyes converge. This is the reaction to accommodation. Abolition of this reflex is due to paralysis of the third cranial nerve.

(10) Papilledema. Choked disk; inflammation of the optic nerve at its entrance into the retina, having a distinct ophthalmoscopic appearance and a symptom of cerebral compression.

(11) Homatropin. A strong mydriatic, which causes mydriasis or dilatation of the pupil.

(12) Photophobia. Abnormal sensitiveness to light, especially of the eyes.

(13) Nystagmus. Rhythmical oscillation of the eyeballs, either horizontal, rotary or vertical, observed in lesions of the cerebellum.

(14) Retinal hemorrhage. This condition may be the result of increased blood-pressure, or of thrombosis of a retinal vein.

(15) Weakness of the left side of the face. An indication of involvement of the facial nerve.

(16) Knee-jerk reflex. The reflex obtained by striking the patellar tendon with a percussion hammer while the leg is flexed upon the thigh at a right angle. Exaggeration of the reflex is noted in spastic spinal paraplegia and cerebral hemorrhage. This reflex may not be elicited in the presence of a semi-comatose state. Abolition of the reflex is noted during the progress of tabes dorsalis, anterior poliomyelitis, peripheral neuritis, and trauma to the spinal cord at the level of the reflex arc (second, third, and fourth lumbar segments).

(17) Babinski's sign (plantar reflex). In the normal subject when the sole of the foot is stroked, plantar flexion of *all* the toes ensues as the reflex response. In the presence of a lesion of the upper motor neurone, instead of uniform plantar flexion of the toes the great toe is extended while the remaining toes are flexed.

(18) Abdominal reflex. A reflex obtained as a neurological test to differentiate between a lesion of the tenth and eleventh, and the eighth and ninth, intercostal nerves.

(19) Kernig's sign. A neurological test employed in cases of suspected acute meningitis. To elicit Kernig's sign the patient should be placed upon the back, with the thigh flexed at a right angle with the body. An effort is then made to extend the leg, bringing it in a line with the thigh. In acute meningitis it is impossible to fully extend the leg, because of the marked flexor contracture of the hamstring muscles.

(20) Blood-pressure. The force exerted by the blood upon the vessel walls, which is expressed in millimeters of mercury in a standard column. Systolic pressure is the pressure of the blood during ventricular contraction (systole); diastolic pressure is the pressure of the blood during ventricular relaxation (diastole). In the normal adult systolic blood pressure is broadly detemined by adding 100 to the patient's age and expressing it in millimeters. The blood pressure here recorded is high for this individual.

(21) Cloudiness of left mastoid. This may indicate a chronic mastoiditis, or the effects of a previous inflammation.

(22) Otological examination. Made in cases of suspected meningitis

because septic processes in the vicinity of the brain, more particularly suppurative inflammation of the middle ear and accessory nasal sinuses, are important causes of secondary meningitis.

(23) Cochlea. A cone-shaped cavity in the petrous portion of the temporal bone, forming one of the divisions of the labyrinth or internal ear.

(24) Chronic catarrhal otitis. A chronic catarrhal inflammation of the ear.

(25) Bulging ear-drum membrane. A symptom of abscess of the middle ear.

(26) Spinal puncture. A puncture into the subarachnoid space of the spinal cord, made between the fourth and fifth lumbar vertebrae, in order to remove an excess of fluid, or a specimen of fluid for examination.

(27) Excess pressure of spinal fluid. Fluid obtained by lumbar puncture is usually in excess, and under increased pressure, in cases of intracranial lesions.

(28) Bloody spinal fluid. Normally the cerebrospinal fluid is clear and limpid, resembling water. Not infrequently it is tinged with fresh blood from a punctured vessel. This should not be confused with the dull red or brown color in hemorrhagic conditions of *intraventricular* and subdural hemorrhage, and *hemorrhagic meningitis*.

(29) Examination of the cerebrospinal fluid. Normally, after lumbar puncture, the fluid will drip from the needle, and the number of drops per minute may be counted. Under high pressure it spurts out. The fluid is normally clear, and alkaline in reaction, and the specific gravity is 1.003 to 1.008. In acute meningitis the fluid may exhibit varying degrees of cloudiness, from slight turbidity to almost pure pus. In meningitis due to meningococcus, pneumococcus, or streptococcus, examination of the fluid reveals an excess of cells (200–10,000 per cmm.), with predominance of the polymorphonuclear leucocytes. Bacteriologic examination of the fluid is of great importance in revealing the specific cause of meningitis.

(30) Centrifugation. The sedimentation of solids suspended in a fluid by means of the centrifuge.

(31) Lumbar puncture. Same as spinal puncture.

(32) Blood culture negative. This negative report indicates that there was no general septicemia.

(33) Urinalysis. Normal urine is usually yellow or reddish-yellow in color. It is clear and slightly acid in reaction. The normal range in specific gravity is from 1.017 to 1.020. Albumin, sugar, acetone, diacetic acid, and indican are abnormal constituents of urine. Few epithelial cells are found in normal urine.

(34) Blood examination. Blood normally contains the following cellular elements: red blood cells, 5,000,000 per cmm.; white blood cells, 7,500 per cmm. The leucocytes are differentiated mainly into (1) polymorphonuclear neutrophilic leucocytes, 60–70 per cent; (2) lymphocytes, 25–33 per cent—endotheliocytes, eosinophilic leucocytes, and basophilic leucocytes are found in small numbers in normal blood. All inflammatory and suppurative processes cause a degree of leucocytosis dependent upon two factors: (a) the severity of the infection and (b) the resistance of the individual.

(35) Pneumococcus grouping (Type IV). Includes miscellaneous strains that cannot be placed in any of the other three groups. The pneumococci of the *normal* mouth are most frequently of this type.

(36) Withdrawal of spinal fluid. Withdrawal of spinal fluid, in conditions where there is an excess of fluid or where the fluid is under increased pressure, is sometimes done as a therapeutic process.

(37) Urotropine (hexamethylenamine). Has no important action itself, but is of interest from its liberating formaldehyde in the course of its excretion in the urine. Formaldehyde is a powerful disinfectant, and the small quantities liberated from urotropine are sufficient to prevent fermentation of the urine for many hours. It has been shown that it appears within an hour in the cerebrospinal fluid. It is sometimes used in large doses in traumatisms of the brain and chord to prevent infection.

(38) Cheynes-Stokes respiration. A type of breathing in which the respirations gradually increase in depth, up to a certain point, and then decrease; finally all respiration ceases for half a minute or so, and then begins as before.

(39) Endarteritis. Inflammation of the endothelial lining (tunica intima) of an artery. Proliferation may take place to the extent that the lumen of the artery becomes obliterated and rupture results (endarteritis obliterans).

(40) Exacerbation. An increase in the severity of a disease or its symptoms.

THE EFFECT OF ACETYL THYROXIN ON THE DEVELOPMENT OF THE TEETH[1]

MARGARET M. HOSKINS, PH.D.

Associate Professor, Microscopic Anatomy, New York University College of Dentistry

It is a matter of common knowledge that the development of the teeth is influenced to some extent by the condition of the thyroid gland. Delayed dentition is to be observed among cretins and mildly hypothyroid patients. Conversely, hyperthyroidism is often accompanied by early eruption of the teeth. Marked fragility of the teeth has also been thought by some writers to be connected with abnormality of the thyroid in adults.

The following pages present a study of the development of the teeth of newborn white rats which received injections of the acetyl derivative of thyroxin. In this derivative certain parts of the molecule have been replaced by the acetyl group, giving a compound which does not affect the metabolic rate of adult mammals (Swingle, '25). It retains, however, its effect on the development of young organisms. Tadpoles to which acetyl thyroxin is given by injections or feeding develop rapidly into frogs. Newborn rats are similarly affected, going through the changes of form normal to the first twenty-five days of life in a period of fifteen days. Differences between normal and injected rats are to be seen in the proportions of the skull and in the development of the hair, eyes, auricles, and feet. These changes, together with the method of the experiments, have been described elsewhere (Hoskins, '27). During the course of the experiments it was noted that eruption of the incisors was hastened in the injected rats, but the point was not studied in detail. The present article includes a brief sketch of the changes occurring in incisors and molars under the influence of acetyl thyroxin.

[1] A preliminary report was published in the *Proceedings of the Society for Experimental Biology and Medicine*, 1927, xxv, p. 55 (October meeting).

The acetyl thyroxin used in these as in other experiments was prepared at the Mayo Clinic from Squibb's crystalline thyroxin. Injections were given every second or third day, beginning when the rats were one or two days old. The general changes in the rats were the same as those described elsewhere. On the third, fifth, and eighth days of life, animals were killed for study. In each case a normal litter mate was killed also and studied for comparison. The observations presented were made from sections. The heads of the animals were fixed in Bouin's fixing fluid. The upper and posterior part of each head was then cut away, leaving the jaws, tongue and surrounding tissues as the piece to be sectioned. This piece was decalcified in weak nitric acid, embedded, and sectioned. The sections were cut sagittally, 20 micra thick, mounted serially, and stained with hematoxylin and eosin. The illustrations were made with a camera lucida.

Plates I and *II* present diagrammatically the normal course of the eruption of the incisor teeth, together with the same phenomenon in injected rats. In *fig. 1* the tip of an upper incisor of a normal rat, three days old, is represented. It has penetrated about a third of the way through the oral epithelium, and just beyond its tip may be seen a small break where the epithelium is giving way to its advance. *Fig. 2* shows the corresponding tooth in a rat of the same litter which had received 0.1 mg. of acetyl thyroxin on the first day after birth. Here the tooth is much further advanced towards the surface of the epithelium, and the breaking down of the latter is more noticeable. Further development of the labial groove is also to be seen in this specimen than in the normal litter mate.

Figs. 3 and *5* illustrate conditions in injected and normal rats respectively at five days of age. The injected animal had by this time received two doses of the acetyl thyroxin, and the upper incisors are completely erupted, while those of the control show a less advanced stage of development. The epithelium is breaking down around the tip of the tooth, but its outer layer remains intact.

Figs. 4 and *6* illustrate the lower incisors at this time, and show that these teeth also are subject to the influence of the injections. In the normal animal (*fig. 4*) the lower incisor has just begun to penetrate the epithelium, and its tip is still far from the surface. In the injected

rat the epithelium shows a large space about the tooth, and seems just about to break away at the surface.

Figs. 7 and *9* illustrate normal conditions on the eighth day. These sketches of upper and lower incisors, respectively, show the teeth just erupting, the upper one being slightly in advance of the lower. Eruption may, however, be delayed till the ninth or tenth day in normal animals. *Figs. 11* and *12* show unerupted incisors from a normal rat nine days old. In this specimen one upper incisor had broken through and was in the condition illustrated in *fig. 7*. The other upper incisor (*fig. 11*), and the two lower ones (*fig. 12*), were still covered by an unbroken layer of the oral epithelium. At the eighth day the teeth of injected rats are well beyond the surface of the epithelium, as may be seen from *figs. 8* (upper) and *10* (lower). The acceleration of development at this stage is marked.

The molars of injected rats are not affected in the same way as the incisors. *Fig. 13* illustrates an upper molar from a normal rat eight days old, and *fig. 14* the corresponding tooth from an injected animal of the same age (*Plate III*). The latter is from the same animal whose incisors are shown in *figs. 8* and *10*. No difference is to be seen between the two molars illustrated. In neither case has the tooth made any great advance towards eruption, and they are in the same stage of development as far as can be seen from the preparations. In this respect there is a marked contrast to the incisors, which we have seen to be strongly influenced by the injections.

It has been thought by some authors that enamel formation is particularly subject to thyroid influence, and on that account a special study has been made of the process in these rats. *Fig. 15* (*Plate IV*) represents diagrammatically the odontoblasts, dentine, enamel, and ameloblasts of the upper incisor of a normal rat at three days of age. The drawing, which was made from the section that contained the greatest amount of enamel, shows that at this time only a thin layer of this substance has been laid down. A much greater amount is to be seen in the corresponding tooth of an injected rat of the same age (*fig. 16*). A comparison of the two sketches shows convincingly that amelification has been stimulated by one injection of acetyl thyroxin. It leaves open, however, the question whether this process has been accelerated more than other processes of tooth formation. To show

that this is not the case, reference is made to *figs. 17* and *18*. The first of these represents the structure of an incisor from a normal rat eight days old; the second is drawn from an injected rat five days old. The two show no difference in the amount of enamel formed. If, now, *figs. 3* and *7* are compared, we shall see that the upper incisors of five-day injected rats show practically the same condition of general development as those of normal animals at eight days of age. The conclusion is, then, that while enamel formation is undoubtedly stimulated by injections of acetyl thyroxin, it is not more responsive to the treatment than any other process of tooth development.

It should be noted that animals injected with acetyl thyroxin are not truly hyperthyroid individuals. The overfunctioning thyroid accelerates metabolism as well as differentiation, while acetyl thyroxin stimulates the latter process only. Therefore our conclusions concern the rate of development, but not abnormalities of the fully formed tooth due to changes in the metabolic rate of the adult. It is clear that the rate of development of the incisors of rats is influenced by the thyroid. In this respect the teeth are like various other structures of the body; for instance the nasal bone, which grows with abnormal rapidity in these same animals. The development is normal in character, but abnormal in rate.

It should also be remembered that the incisors of rats are different from human teeth and from the molars of rats, in that they grow actively throughout the life of the animal. Donaldson and French ('27) have shown that the molars of rats also continue to grow in diameter, but their increase in size is not nearly so great as that of the incisors. Attempts have been made to correlate overgrowth of certain teeth in human beings with particular endocrine abnormalities; for instance, enlarged canines have been considered by some to be a sign of excessive adrenal activity. Although it has been shown in the above study that the growth of the incisors of rats is more accelerated than that of the molars, the facts do not warrant the conclusion that human incisors are more influenced by the thyroid than other teeth. It is more probable that the difference observed is due to the peculiarly active growth tendency in rat incisors.

The experiments give no explanation for enamel deficiencies in hypothyroid patients. Amelification is stimulated by the injections,

but not more than any other process of tooth development. One must conclude that the fragile enamel seen in hypothyroid patients is a result of disturbed metabolism, not a developmental anomaly.

SUMMARY

1. Acetyl thyroxin injected into newborn white rats causes an acceleration of the development of the incisor teeth.

2. The development of the molars of the same rats is not accelerated by the treatment.

3. The formation of the enamel of the incisors is accelerated by the injections, but is not more affected than any other process of tooth development.

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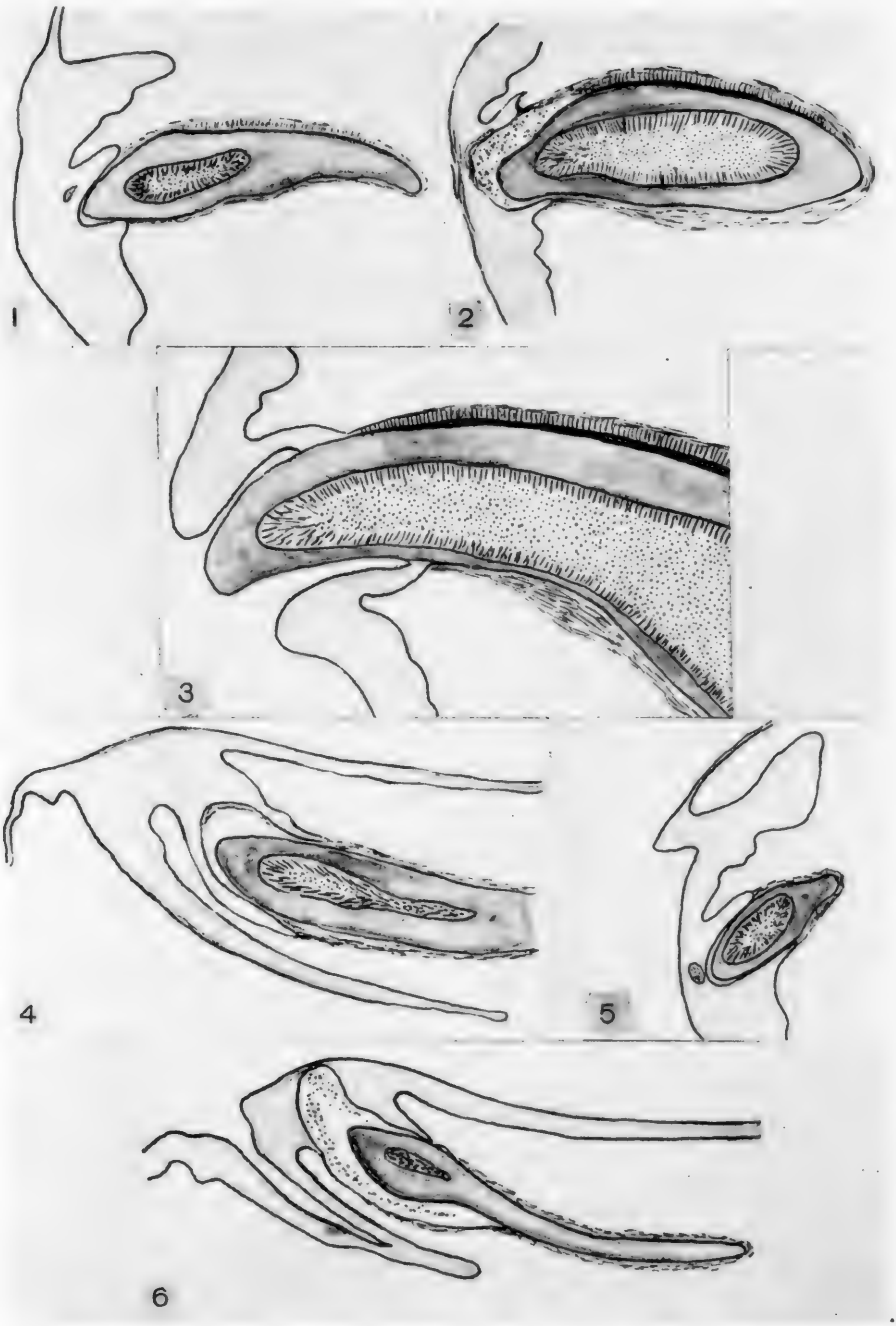
PLATE I

FIG. 1. Tip of upper incisor, normal rat three days old.
FIG. 2. Tip of upper incisor, injected rat three days old (0.1 mg. acetyl thyroxin).
FIG. 3. Tip of upper incisor, injected rat five days old (0.2 mg. acetyl thyroxin).
FIG. 4. Tip of lower incisor, normal rat five days old.
FIG. 5. Tip of upper incisor, same rat as *fig. 4*.
FIG. 6. Tip of lower incisor, same rat as *fig. 3*.



(Hoskins: Acetyl Thyroxin on Growth of Teeth.)

PLATE II

FIG. 7. Tip of upper incisor, normal rat eight days old.
FIG. 8. Tip of upper incisor, injected rat eight days old (0.3 mg. acetyl thyroxin).
FIG. 9. Tip of lower incisor, same rat as *fig. 7*.
FIG. 10. Tip of lower incisor, same rat as *fig. 8*.
FIG. 11. Tip of upper incisor, normal rat nine days old.
FIG. 12. Tip of lower incisor, normal rat nine days old.

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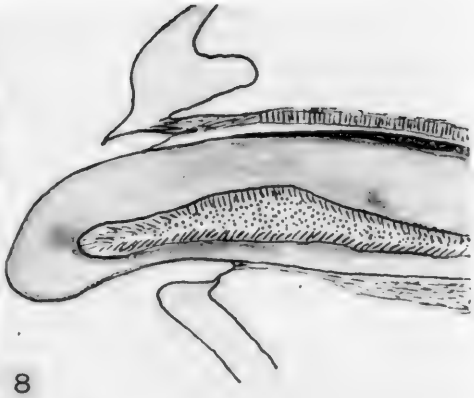

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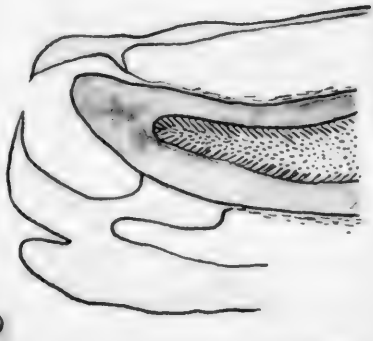

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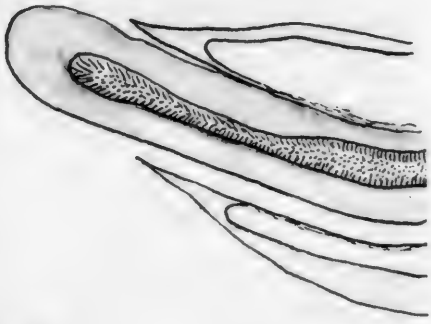

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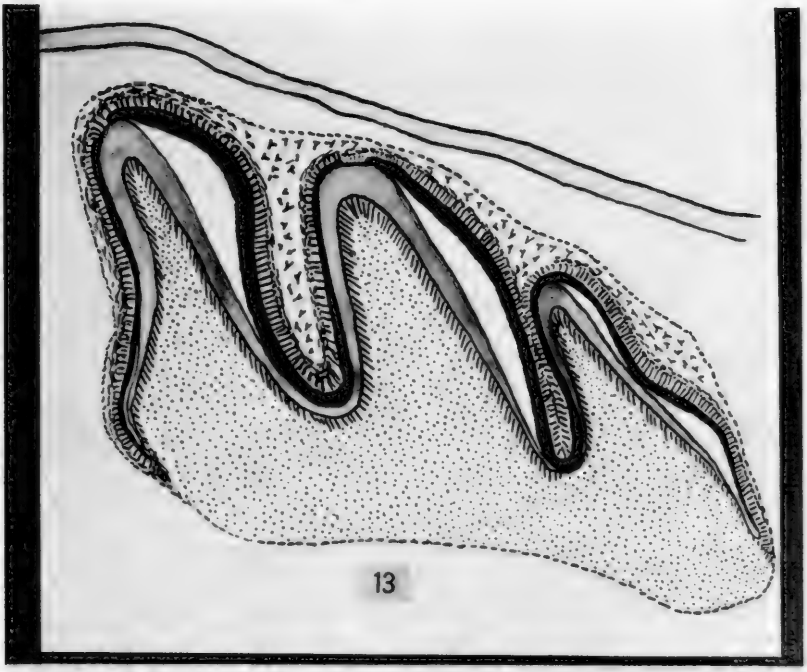
(Hoskins: Acetyl Thyroxin on Growth of Teeth.)

PLATE III

FIG. 13. Upper molar, normal rat eight days old.
FIG. 14. Upper molar, injected rat, eight days old (0.3 mg. acetyl thyroxin).



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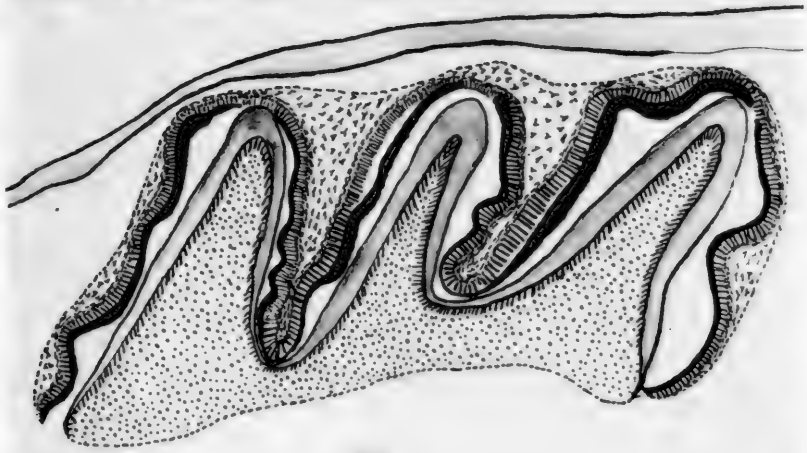

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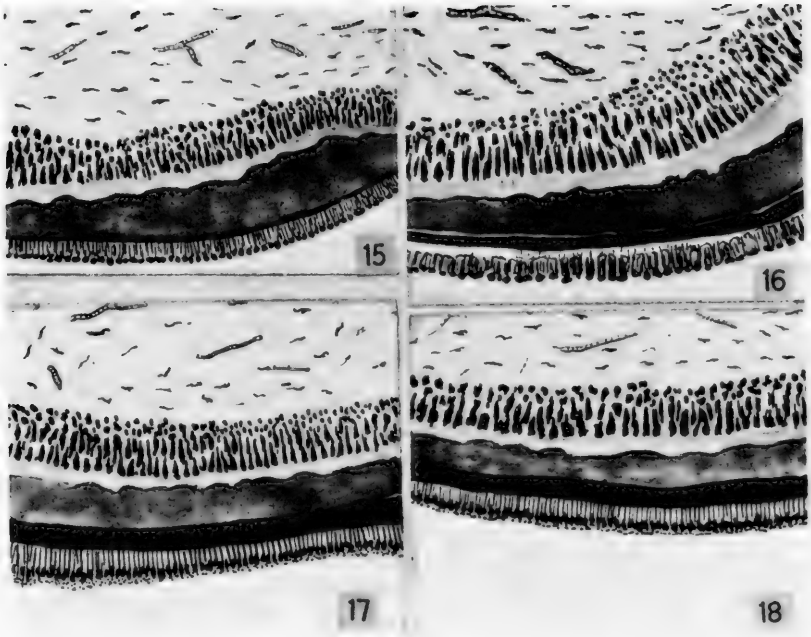
(Hoskins: Acetyl Thyroxin on Growth of Teeth.)

PLATE IV

FIG. 15. Enamel formation, normal rat thirteen days old.
FIG. 16. Enamel formation, injected rat three days old.
FIG. 17. Enamel formation, normal rat eight days old.
FIG. 18. Enamel formation, injected rat five days old.



(Hoskins: Acetyl Thyroxin on Growth of Teeth.)

UNIV. OF MICH.

OBSERVATIONS ON THE GROWTH OF THE MANDIBLE[1]

THEODORE B. BEUST, M.D., D.D.S.
School of Dentistry, University of Louisville

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INTRODUCTION

The observations here recorded are the result of a study of the mandible of the pig. Attempts were made to register some of the changes which transformed the jaw of the young into that of the adult animal. Notations of variation occurring in the antero-posterior dimension were based on growth following the functional alignment of the first permanent molar in the occlusal plane (*fig. 1*), while the observations on the superior-inferior dimension were begun shortly before the eruption of this tooth (*fig. 13*).

In order to determine the antero-posterior growth, a mandible with the third molar crypt in an early stage of development (*fig. 1*) was, rather arbitrarily, divided into halves by a vertical line that bisected the horizontal plane at the mesial surface of the first permanent molar (*fig. 1, h*). Using this line as a basis, and measuring by the method illustrated in *fig. 1*, the jaws shown in *figs. 2, 3, 4*, and *5* registered as follows:

Fig. 2—anteriorly $9\frac{3}{4}$ centimeters: posteriorly $10\frac{1}{2}$ centimeters.
Fig. 3—anteriorly 10 centimeters: posteriorly $11\frac{1}{4}$ centimeters.
Fig. 4—anteriorly 11 centimeters: posteriorly $13\frac{1}{2}$ centimeters.
Fig. 5—anteriorly $13\frac{3}{4}$ centimeters: posteriorly $17\frac{1}{2}$ centimeters.

These data show that the chief increment of bone, as has been variously pointed out (1, 2), is in the posterior half. There is

[1] Work supported in part by a grant from the Research Commission of the American Dental Association.

however also a marked development of the half anterior to the first molar. A casual examination of the differences seen in this part of the mandible would refer the gains to the marked development in the incisor region that normally occurs in these animals. Yet, if the surface of bone between the genial tubercles, a point utilized by Tomes (1, a), be selected as a basis from which to determine, slight increases may also be noted (*figs. 6* and 7). It must not be overlooked however that bone is generally believed to enlarge by appositional (sub-periosteal) deposition only, which in its effect would move this surface backward as the jaw increases in diameter, thus nullifying a part of the gains registered. Notwithstanding this fact, *figs. 6* and 7 display a variation of a few millimeters in favor of the older mandible, the antero-posterior growth having been more than sufficient to compensate for the increase in the diameter of the bone, which is considerable in these animals. Exceptionally the older mandibles (*fig. 8*) register slight losses, due, as will be shown below, to the forementioned increase in diameter. Therefore, to preclude any source of error, a point midway between the anterior and posterior layer of cortical bone at the symphysis, which would more rationally represent a standard for the measurements, should be selected. The bones pictured in *figs. 6* and *8* were accordingly halved, the results being shown in *figs. 9* and *10*, a gain of 17 millimeters being evident. It would be difficult to correlate the difference here shown with any process of sub-periosteal growth, rather would an interstitial growth be inferred. (Compare Wedl, 1b.)

OCCLUSAL PLANE

As a concrete illustration of Tomes's statement (1, c) that retained deciduous teeth sometimes become elevated to the general level of the permanent teeth, the following observations, with various additions showing that this is a perfectly normal growth, are presented.

The straight edge lying parallel to the occlusal plane of *fig. 1* indicates that both the deciduous and permanent molars stand in the same relation to the plane. Partly covered by the metal arch (*g*), and lying very near to the continuation of the occlusal plane, is seen (*f*) the crypt of the third permanent molar, which is just beginning its development. Growth of the mandible in its perpendicular dimension

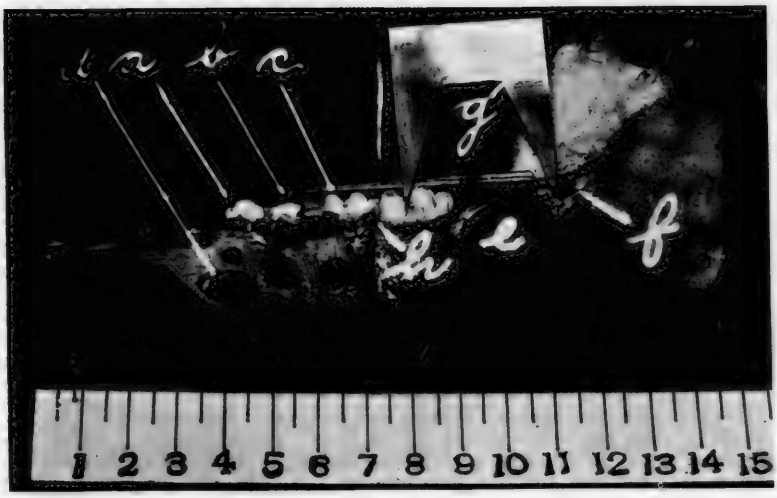

Fig. 1. *a*, *b*, *c*—First, second, and third deciduous molars respectively (the first premolar is here regarded as a permanent tooth). *d*—Crypt of permanent canine. *e*—Crypt of second molar. *f*—Young crypt of third molar. *g*—Metal arch for establishing the distance between the buccolingual groove of the first molar and the anterior wall of the third molar crypt.

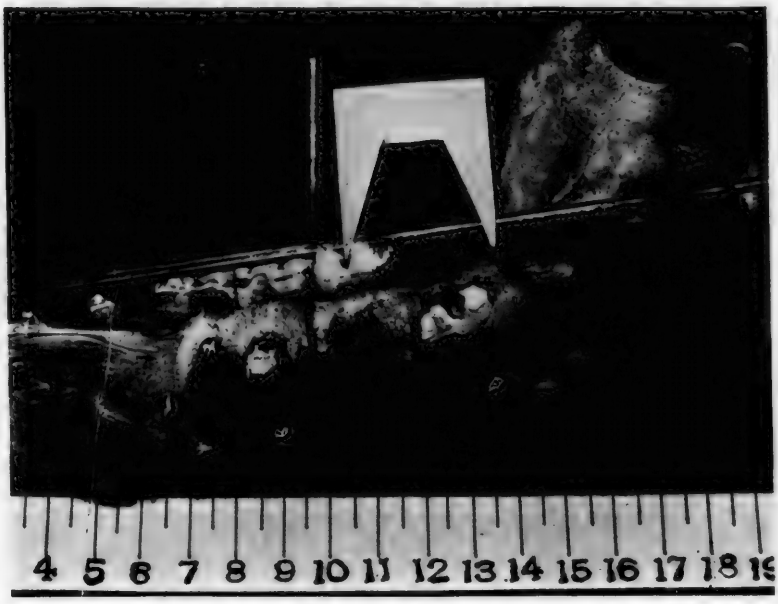

Fig. 2. Third molar crypt, seen to have developed toward the posterior part of the mandible.

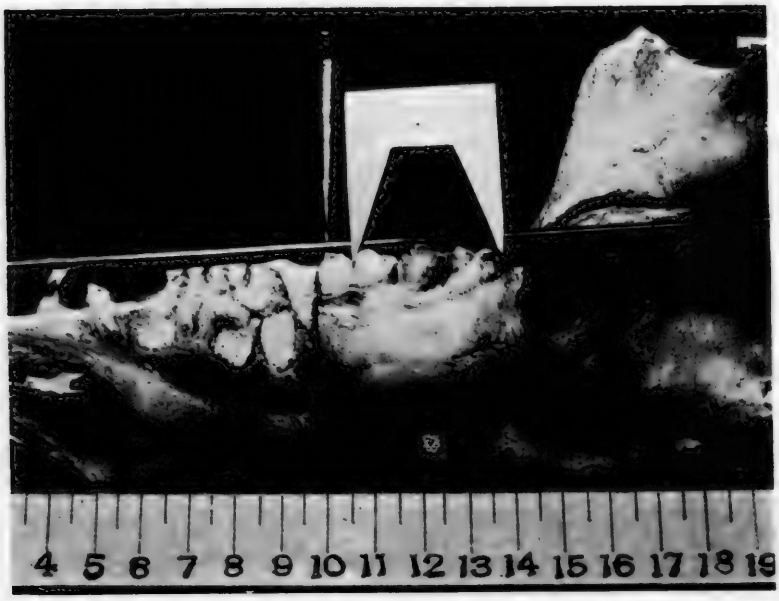

Fig. 3. The second molar is erupting. The third molar crypt is posterior to the metal arch, and still occupies space near the occlusal plane.

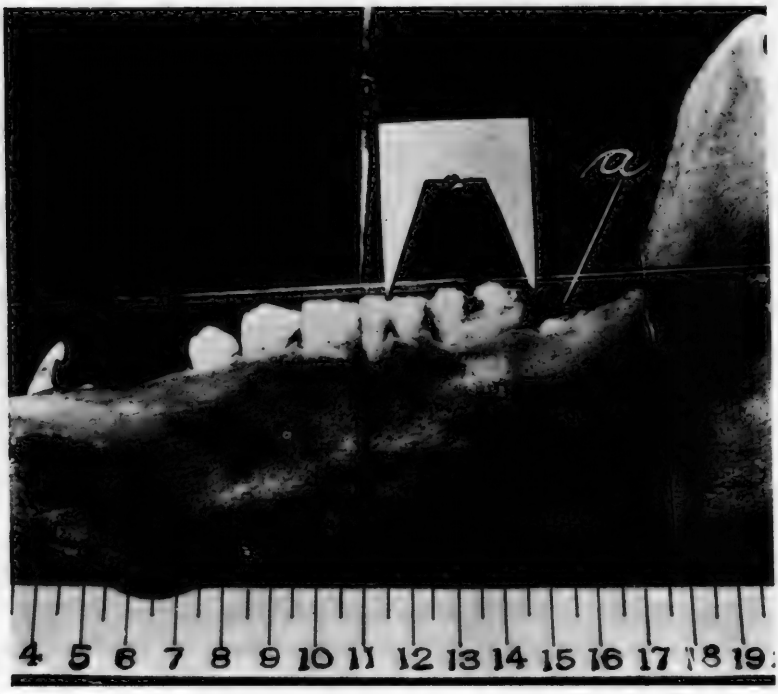

Fig. 4. The second molar has completely erupted, the third molar being in a state of eruption.

may well be determined by using the upper part of the anterior wall of this crypt as a fixed point. Lying in immediate apposition to the mandibular canal, it is not reasonable to suppose that this crypt de-

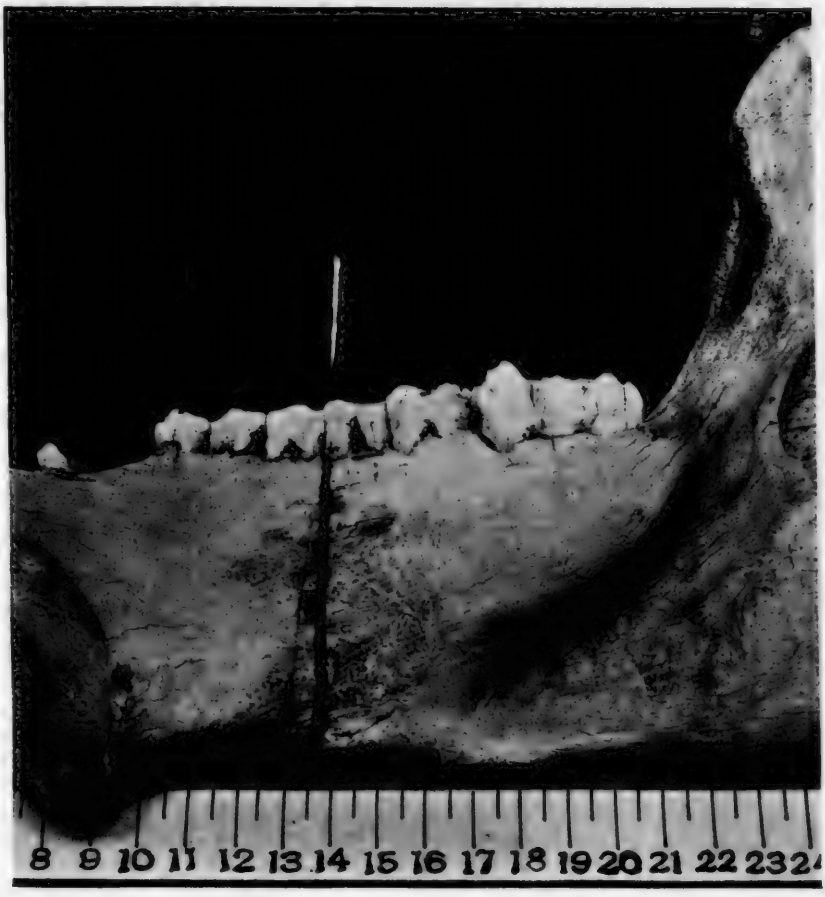

Fig. 5. This mandible, measured by the method for *fig. 1*, was 31 centimeters long.

scends during its development. Assuming, then, that the molar follicles, which are perched on the mandibular canal (the mandibular canal is one of the fixed points mentioned by Tomes), do not grow

downward, a comparison between the jaws in *figs. 13* and *9* demonstrates that the morsal surfaces of the functional teeth have, during the transition shown in *fig. 13* into the stage of development shown in *fig. 9*, heightened at least the distance between the straight edge and the morsal surface of the second molar (*fig. 9*). By reverting to the time when the third molar follicle (*fig. 3*) occupied the same relative position to the plane that the second molar follicle displays in *fig. 13*, careful comparisons between these figures and *fig. 4* make it evident that the occlusal plane has undergone the same shifting upward with the growth of the second molar that was seen to occur in the foregoing

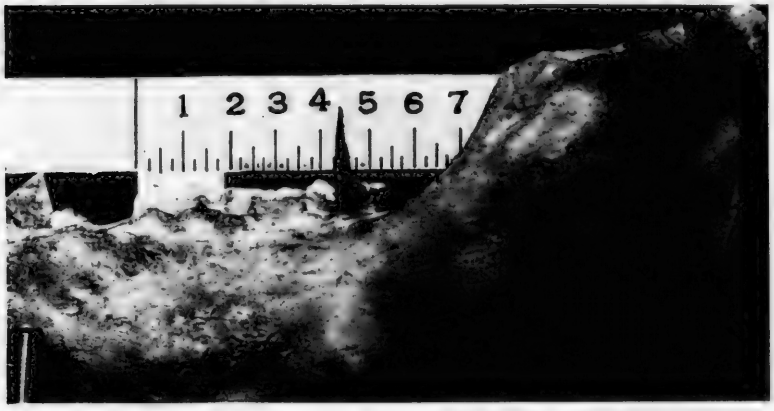

Fig. 6. The T-square rests against the bone in the bifurcation, the scale is in the occlusal plane. A rod bearing an indicator lies in the buccolingual groove of the first molars.

illustration, the morsal surfaces in each of these cases (in the first instance, the first molar over the second—*fig. 9;* in the second instance, the second molar over the third—*fig. 4*) having been raised to the extent of the height of a follicle. Expressing the upward trend diagrammatically in terms of tooth crowns (*fig. 12*), the first molar and with it the occlusal plane of *fig. 13* ascends (*fig. 12, A*), leaving the follicle (*fig. 13 b*), which in the early stage occupied a position at the end of the plane, the height of a molar crown below (*fig. 12, B*, and *fig. 9*, mandible). In the further development of the jaw (*fig. 9*) into the condition shown in *fig. 4*, in which the second molar is erupted, we have

Fig. 7. The T-square rests against the bone in the bifurcation, the scale is in the occlusal plane. A rod bearing an indicator lies in the buccolingual groove of the first molars. This mandible is older than the foregoing, the *second* molar having erupted.

Fig. 8. The T-square rests against the bone in the bifurcation, the scale is in the occlusal plane. A rod bearing an indicator lies in the buccolingual groove of the first molars. This mandible is older than the foregoing, the *third* molar having erupted.

a repetition of the upward shifting, the second molar in attaining its place in the occlusal plane having left the third molar the distance of the height of a tooth crown below (*fig. 12, C*). The first permanent

Fig. 9. The vertical lines in figs. 9 and 10, drawn from the buccolingual grooves of the first molars, register the differences in length.

Fig. 10. The vertical lines in figs. 9 and 10, drawn from the buccolingual grooves of the first molars, register the differences in length.

molar has accordingly advanced the distance (*d*) to (*e*), and later the distance (*g*) to (*f*), in *fig. 12*. This is the least amount of vertical movement that should be credited to this tooth, much more undoubtedly

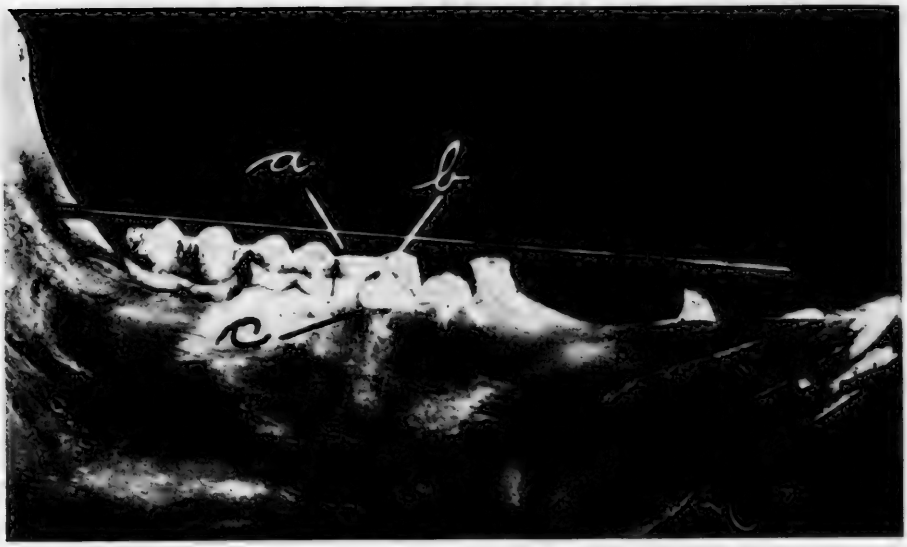

Fig. 11. *a*—Third temporary molar. *b*—Fourth permanent pre-molar. *c*—Alveolar process.

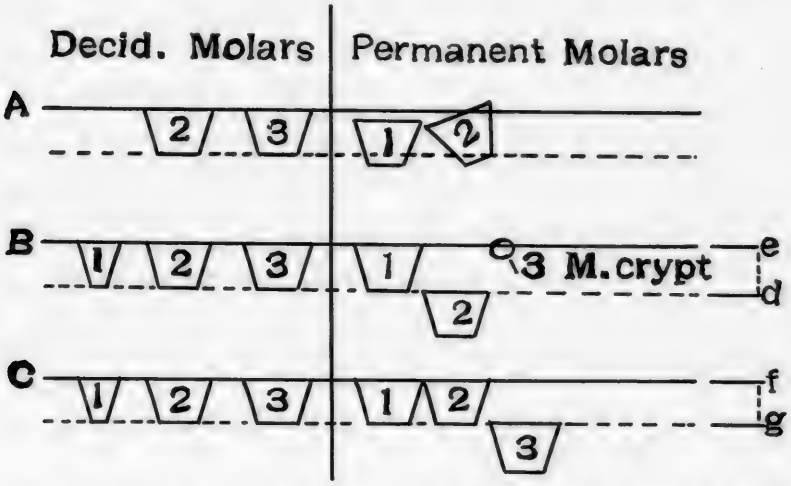

Fig. 12. Diagram relating to development of the jaw. *A*.—Stage shown in *fig. 13*. *B*.—Stage shown in *fig. 1*. *C*.—Stage shown in *fig. 4*.

occurring. The temporary molars, the roots of which are completely formed before the mandible advances to the development shown in *fig. 1*, share in this vertical movement, as is seen by referring to the occlusal planes pictured. Always retaining their place in the plane,

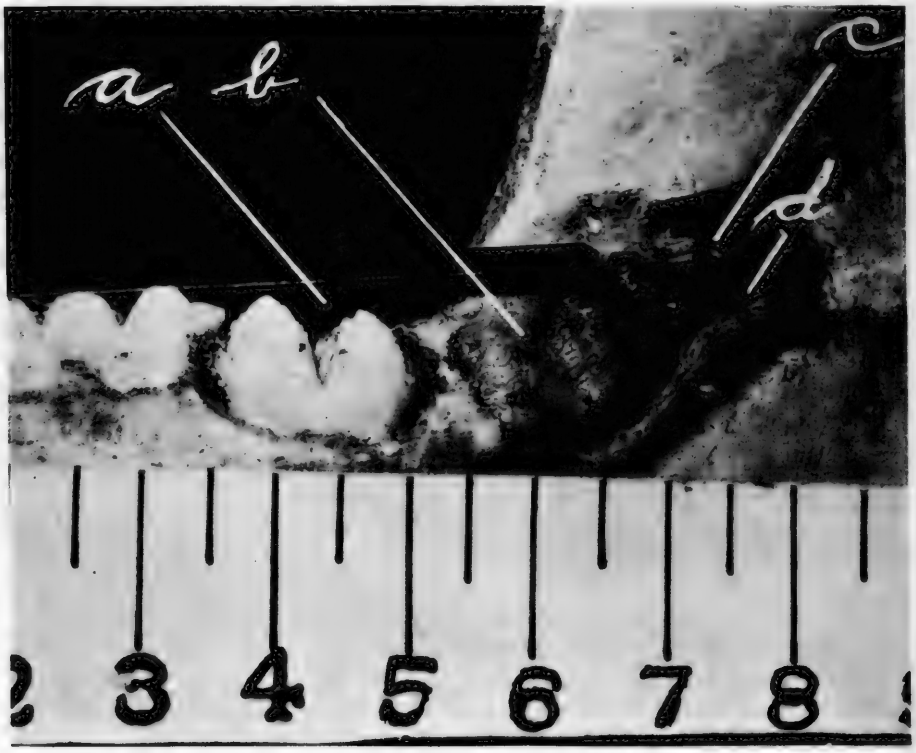

Fig. 13. a—Erupting first permanent molar, the bone covering of which has been removed. *b*—Follicle of second permanent molar. *c*—Posterior extension of the dental lamina, upon which the follicle of the third molar will develop. *d*—The mandibular vessels and nerves immediately outside of the foramen. The scale is in centimeters.

the distance travelled by these teeth therefore amounts at least to double the height of a molar crown. If the root apices of these molars, which were at one time in close relationship to the mandibular canal, be used as a basis for measurement, the third deciduous molar (*fig. 14, g*) would show a 17-millimeter growth above the canal. Two

Fig. 14. *a* and *b*—First and second permanent molars, respectively. *c*—Third molar crypt. *d*—Gubernacular canal. *e*—Mandibular canal. *f*—Root of canine. *g*—Third temporary molar.

and one-half molar crowns, one on top of the other, would easily find place between the neck of this tooth and the mandibular canal. The mandible (*fig. 14*) has not yet completed its development, the third

Fig. 15. a, a—Erupting third molars.

molar still occupying space at the end of the occlusal plane. Specimens with the root apices of first permanent molars 24 millimeters above the mandibular canal have been noted.

ALVEOLAR PROCESS

A differentiation between the crypt wall and the alveolar process should be made. The inner wall of the crypt is evidently the product

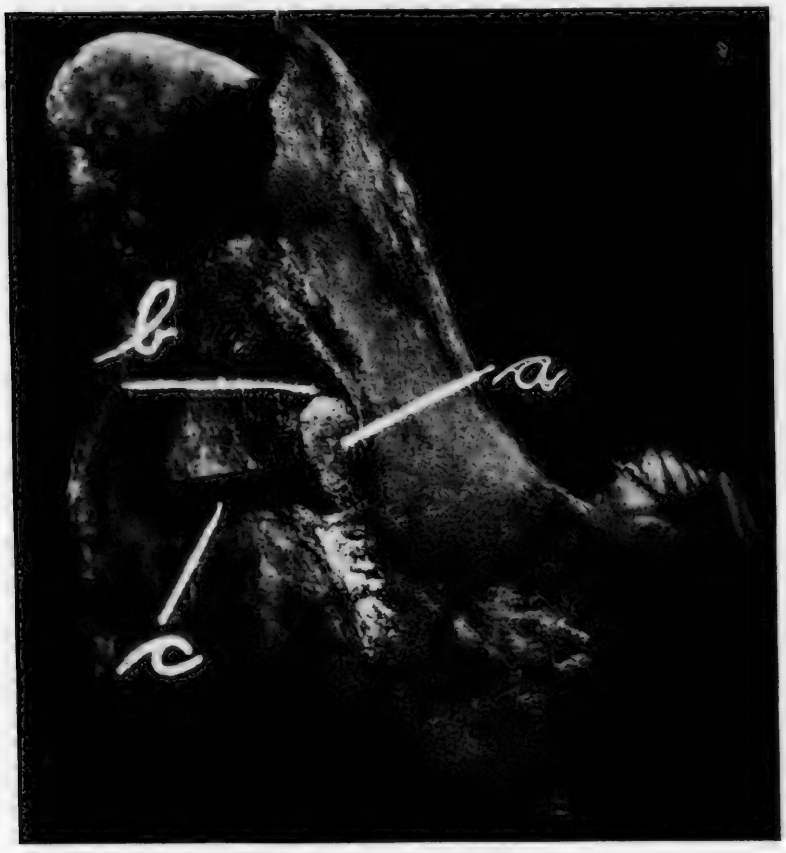

Fig. 16. *a*—Wall of crypt of third molar, outside of the bone, as it is sometimes seen. *b*—Posterior gubernacular foramen. *c*—Rod inserted in the mandibular canal.

of the individual follicle (3). Yet the alveolar process is not composed solely of these inner walls. Tomes, Black, Talbot, and others give definitions which obviously include also the external walls of the alveoli. The following remarks apply to the visible external parts

of the dentary bone that enclose the alveoli. Tomes says (1, d): "The alveolar portion of the jaw, that which lies above the inferior dental canal, is developed around the milk teeth. When they are lost it disappears, to be reformed again, for the second set of teeth . . . . ." The latter part of this much quoted conception, which has found access to text-books (4), appears incompatible with conditions as they are seen to exist. Loss of the alveolar bone is not a necessary concomitant of tooth eruption (*figs. 11, c; 4, a; 15, a*), showing that in each case the erupting tooth finds its bony support preformed. The conditions would appear to be more properly expressed by stating that "alveolar bone, sufficient in amount to provide an opening for the emerging tooth, is removed." As may be noted from the illustrations, the alveolar bone accompanies the temporary teeth in their upward movement, necessity for a limited amount of rebuilding arising only to the extent of the excess in transverse measurement of the permanent over the temporary tooth. While absorption during the replacement of the anterior superior teeth of man may be considerable, alveolar losses attending the process of eruption, as might be inferred from prevailing opinions, are not a necessary physiological manifestation.

INFLUENCE OF THE THIRD MOLAR

It has been claimed that the third molar in its development may cause a shifting of the teeth anterior to it. The following remarks may cast some light on the plausibility of this view.

If the relation of the metal arch, *fig. 1, g*, marking the distances between the buccolingual groove of the first permanent molar and the anterior wall of the third molar crypts of *figs. 1, 2* and *3*, be studied, it will be evident that the molar follicles provide room for their expansion, not in a forward but in a backward direction. That this growth should in any manner influence the alignment of the functional teeth appears unlikely. Beginning as a pulp-like mass, remaining up to the time of its eruption surrounded by soft tissue and always enclosed in a bony crypt, it apparently absorbs, not forces, the necessary space for its expansion. That dynamic influences, which alone would qualify as a source of shifting, enter as a factor, is not probable. The labile nature of this part of the bone, the proximity to the mandibular canal,

the delicate lingual wall of the crypt as well as its parchment-like posterior wall (*fig. 16*), collectively appear to exclude this tooth as a potential factor in causing malformations anterior to it. As the third molar follicle is seen to grow upward and backward, its presence evidently does not have an influence on the lengthening of the jaw, except in a phylogenetic sense, the crypt of this tooth lying mainly outside of the direct line, against the much stronger buccal portions of the bone. Pressure, then, would logically demand a compact base for its operation, the frail septa separating the follicle from the soft parts being insufficient for its exercise. Malposed third molars, assuming analogically a kind of epicotyllar growth, would, if disposed longitudinally, exert pressure. Yet this assumption, in view of the magnitude of the antagonizing forces lying anteriorly, would scarcely prove an adequate explanation of deformities that occur.

A consideration of variations in the width of the arches, and of changes seen to occur in the ramus, demands a new series of photographs, which at this time are not available.

The measurements here recorded were checked over a collection of sixty mandibles and found to be a fair portrayal of the conditions.

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